RITCHIE'S

ILLUSTRATED CATALOGUE

OF

PHILOSOPHICAL INSTRUMENTS.

RITCHIE'S

ILLUSTRATED CATALOGUE

OF

PHILOSOPHICAL INSTRUMENTS,

AND

SCHOOL APPARATUS.

ROOMS, 313 WASHINGTON STREET,
BOSTON.

ELECTROTYPED AT THE
BOSTON STEREOTYPE FOUNDRY.

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17 Doane St.

PREFACE.

SINCE the publication of my last Catalogue, the variety of instruments which I manufacture has so greatly increased, and the improvements and changes in apparatus have become so numerous and important, that I have felt it expedient to make an entire revision of the work.

Few branches of study in our schools are of more practical importance than Natural Philosophy, and it is only by the use of proper apparatus that its principles can be adequately elucidated.

Until a comparatively recent period, the attention bestowed upon this subject has been confined to a few of the elementary principles. The apparatus used has been limited to such instruments as illustrate the more obvious laws of ponderable matter, while the principles of Optics, Heat, Acoustics, &c., have been taught imperfectly, if at all, by experimental method. The list of instruments wanted for a school has therefore been confined to a few branches, in some of which a needless multiplicity of articles are introduced illustrating the same principle in a slightly different manner. It has thus frequently happened, that while the simple laws of the pressure and elasticity of the air have been exemplified in twenty ways, the science of Optics has had no larger means of experiment than a single prism, and Acoustics has been left entirely unprovided.

Of late years, however, the growing interest in physical science, as a branch of common education, has created a desire for more ample and varied means of experimental demonstration; and our schools and colleges are aiming to provide themselves with the essential pieces of apparatus in each of its departments.

It has been my earnest desire and effort to keep pace with the progress of physical science, and as new principles have been discovered or developed, to devise and construct new instruments, to improve the old, and to add to my list many which could heretofore only be procured from Europe.

It has been my aim to excel in the quality and finish of my

apparatus; so that in these respects, as well as in adaptation, in graceful form and proportions, whatever goes from my manufactory shall take rank with the best products of European make.

To secure these results, very perfect machinery has been provided, the best of materials are used, and skilful workmen are employed. As evidence of my success thus far, in attaining such results, I would ask attention to the following letters received from distinguished physicists.

E. S. RITCHIE.

CAMBRIDGE, Sept. 10, 1857.

This may certify that Mr. E. S. Ritchie is well known to us as an unusually well educated and intelligent manufacturer of the best philosophical instruments, used in academies and colleges. He is not content with supplying the usual apparatus found in all the catalogues, but he is ambitious to add to it new articles, which illustrate fresh discoveries in science, or which excite a scientific curiosity. He has taken a journey to Europe, in order to make himself familiar with the progress of his art; and by his improvement in the construction of Ruhmkorff's Inductive Apparatus, he has proved himself capable of profiting by his great advantages. His integrity, his urbanity, and his skill, all equally entitle him to the confidence of those who purchase or use philosophical apparatus.

JOSEPH LOVERING,
Hollis Professor of Mathematics and Natural Philosophy in Harvard College.

JOSIAH P. COOKE, JR.,
Erving Professor of Chemistry and Mineralogy in Harvard College.

BOSTON, Aug, 10, 1857.

I take pleasure in bearing testimony to the great skill, faithfulness, and ingenuity of Mr. Ritchie, as a maker of Philosophical Instruments. Uniting an ample knowledge of scientific principles to large experience in the mechanical details of his profession, his work commends itself not only to institutions seeking apparatus for lecture-room illustration, but to men of science pursuing original research.

WILLIAM B. ROGERS.

U. S. MILITARY ACADEMY, WEST POINT, Aug. 31, 1857.

I have had occasion to use several pieces of apparatus from the manufactory of Mr. E. S. Ritchie, and found them of excellent workmanship, and well devised to subserve the purposes for which they were constructed.

WM. H. C. BARTLETT.

NEW YORK, Sept. 9, 1857.

I have great pleasure in offering my testimony to Mr. Ritchie's merit as a scientific mechanician. I have repeatedly examined and habitually use apparatus of his construction, and am perfectly satisfied with both design and workmanship. Mr. Ritchie's success in constructing the Electro-Magnetic Induction Apparatus has been very remarkable. It is gratifying to me to state farther that Mr. Ritchie owes his success in constructing this beautiful instrument to his own scientific knowledge and ingenuity, and that his mode of construction is both new and original.

WOLCOTT GIBBS,
Prof. of Chemistry and Physics in the Free Academy of New York.

UNIVERSITY OF PENNSYLVANIA,
PHILADELPHIA, July 10, 1857.

Having used with much satisfaction a variety of apparatus manufactured by Mr. E. S. Ritchie, I take great pleasure in bearing testimony to his ingenuity and scientific skill as a Philosophical Instrument maker.

R. E. ROGERS,
Prof. of Chemistry in the University of Pennsylvania.

ORDNANCE OFFICE, U S NAVY YARD,
BOSTON, MASS., July 2, 1856

SIR: I have no hesitation to state that all your work for the Bureau of Ordnance and Hydrography, since my connection with that department of the navy, has been very satisfactory to me and creditable to your establishment, and that for the excellence of workmanship and punctuality in engagements, I shall continue to give your establishment the preference.

Very respectfully, your ob't serv't,
J. S. MISROOM,
Com. U. S. Navy and Insp. Ordnance.

MR. E. S. RITCHIE, Boston.

NEW YORK, Sept. 1, 1857.

It is with great pleasure that I offer my testimony in favor of the excellent Philosophical Instruments constructed by Mr. E. S. Ritchie, of Boston. I have uniformly found them accurately and carefully made, durable and elegant. Mr. Ritchie seeks not alone to equal the best foreign instruments, but to surpass them, and to keep pace with the advancement of science. In this he succeeds, as shown in his improved Induction Apparatus. I have had repeated proofs of a characteristic possessed by Mr. Ritchie, which I feel confident will be appreciated, viz., the sympathy and interest he manifests with the success of the experimenter, associated with a pride for his reputation, punctuality, and a determination to accomplish his aims.

Respectfully submitted,
R. OGDEN DOREMUS, M. D.,
Prof. Chemistry, N. Y. Medical College,
" " " *College of Pharmacy.*

GAMBIER, OHIO, June 7, 1856.

The undersigned would beg leave to commend to the favorable notice of such institutions as may be desirous of obtaining the most perfect Philosophical Apparatus, the establishment of Mr. E. S. Ritchie, of Boston. The Electrical and Pneumatic Apparatus furnished by him for Kenyon College, surpass in beauty of finish and satisfactory performance any thing of a similar kind we have seen.

LORIN ANDREWS,
President of Kenyon College.
HAMILTON L. SMITH,
Prof of Natural Science.

NORWICH, Aug. 3, 1857.

I have purchased of E. S. Ritchie, Esq., something more than a thousand dollars worth of apparatus for the Norwich Free Academy. This apparatus is of superior workmanship, and has given me more than satisfaction. I can recommend Mr. Ritchie's apparatus with entire confidence. Those who may have occasion to order articles of him from a distance, will find their orders faithfully attended to. The work, I think, will be as thoroughly done as if it were executed under their immediate inspection. Mr. Ritchie is ambitious, in the manufacture of apparatus, to keep pace with the progress of science, and no expense is spared to incorporate the latest improvements.

I find his new pattern of the Electrical Machine, in which the positive and negative conductors are of equal size, together with a large prime conductor, which can be used or not, at pleasure, very efficient and convenient.

ELBRIDGE SMITH,
Principal of Norwich Free Academy.

MEDFORD, MASS., 10th Sept., 1857.

MR. RITCHIE.

DEAR SIR: The Philosophical Apparatus which you made for Tufts College combines in its construction strength, high finish, and great beauty of design. It has given us entire satisfaction. I am glad to give my testimony to your merit as a skilful and perfectly reliable manufacturer of Philosophical Instruments.

Yours very truly,

JOHN P. MARSHALL,

Prof. of Natural Philosophy, Tufts College.

GROTON, July 10, 1857.

MR. E. S. RITCHIE.

We are happy to say that the Philosophical Apparatus recently purchased by the Trustees of Lawrence Academy, proves to be of excellent quality, and that it answers admirably every purpose and use in the department of instruction to which it belongs. We can, with entire confidence, say that in our judgment purchasers of School Apparatus will find at your establishment such articles as they desire, made in a style of superior workmanship, and with the latest improvements.

Very truly yours,

C. HAMMOND,

Principal of Lawrence Academy, Groton, Mass.

FARMERS' HIGH SCHOOL, PENN., MAY 15, 1859.

DEAR SIR: * * * * I am much pleased with the instruments. I had recommended your establishment to the trustees of this institution, after using almost constantly for three years a set of your manufacture.

The construction and finish of this set is also much admired.

Yours truly,

J. F. WHITMAN.

WISCONSIN UNIVERSITY, July 25, 1857.

Most of the Philosophical Apparatus in use at the Wisconsin University was procured of Mr. E. S. Ritchie, Boston, and in my judgment of the best quality. Those desirous of purchasing any thing in his line will, I am confident, find it to their advantage to call on Mr. Ritchie, whom they will find to be a man of science.

J. W. STERLING,

Prof. Mathematics, Nat. Philosophy and Astronomy.

OFFICE OF SUP'T PUBLIC SCHOOLS, CHICAGO, Feb. 15, 1859.

The Board of Education of this city has recently purchased of E. S. Ritchie, of Boston, one thousand dollars' worth of Apparatus, for the use of the Chicago High School. In thoroughness of workmanship and elegance of finish, it is unsurpassed by any apparatus that has fallen under my observation. Its performance is in the highest degree satisfactory.

W. H. WELLS,

Superintendent Public Schools.

MT. PLEASANT, N. C., Dec. 23, 1859.

MR. E. S. RITCHIE.

DEAR SIR: The lot of Philosophical Apparatus ordered from you has safely come to hand. We are all highly pleased with the exactness, the practical working, and superior mechanical finish of your instruments; and take pleasure in recommending all institutions, desirous of making a similar purchase, to your establishment.

Yours respectfully,

D. H. BITTLE,

Pres't of North Carolina College.

YALE COLLEGE LABORATORY, June 17, 1859.

Scientific men in the United States, and teachers generally, are under many obligations to Mr. Ritchie, not only for the general superiority of his apparatus, but especially for his enlightened enterprise in undertaking many things for which we have before depended on Europe. His improved Ruhmkorff coil is an example of this kind. By important improvements of his own in the construction of this apparatus, the most energetic source of statical electricity is brought within the means of our small institutions.

I have found Mr. Ritchie ready at all times to undertake commissions out of the routine of his business, relying for his reward upon the reputation growing out of such a course.

All the apparatus which I have had from Mr. Ritchie has been exceedingly well made, and has given me entire satisfaction. His stock of Physical and Chemical Apparatus is excellent: the pieces are well made, in good taste, and of reasonable price.

B. SILLIMAN, JR.

AMHERST COLLEGE, Feb. 11, 1860.

I am happy to direct the attention of teachers in Physical Science to the establishment of E. S. Ritchie, of Boston, who manufactures Philosophical Apparatus extensively, and of excellent quality. Mr. Ritchie aims not only to furnish all the common articles used by schools and colleges, but to add, from time to time, such newly devised instruments as promise to be useful means of instruction Those who consult him in his department of business, will find him intelligent and ingenious, and what is often of prime importance to teachers, a prompt and faithful correspondent.

The recent improvements of Ruhmkorff's electro-magnetic coil has acquired for Mr. Ritchie a wide reputation among men of science.

E. S. SNELL,
Professor of Math. and Nat. Philosophy.

UNIVERSITY OF VIRGINIA, April 9, 1860.

During the last three years I have procured from Mr. E. S. Ritchie a number of pieces of Philosophical Apparatus, some of which are well fitted to test both his science and his skill as an instrument maker. I am happy to say they have fully sustained his extended reputation in both respects. The success he has met with, not only in the construction of the more ordinary instruments, but in the introduction and improvement of new forms of apparatus, eminently entitles him to the support of all who cultivate physical science.

FRANCIS H. SMITH.

WILLIAMSBURG, VA., NOV. 14, 1859.

E. S. RITCHIE, ESQ.

DEAR SIR: The Chemical and Philosophical Instruments selected by Prof. William B. Rogers from your establishment, for the College of William and Mary, have been received. In accuracy, in completeness, in finish, and indeed in all respects, they give entire satisfaction. I take pleasure in recommending you as an accomplished artist, and as an accommodating gentleman, with whom it is most agreeable to form business relations. With much respect, yours sincerely,

BENJ. S. EWELL,
Prof. Nat. Philosophy and Chemistry, College of William and Mary.

ST. LOUIS, MO., Nov. 28, 1859.

SIR: The apparatus, Air Pump, &c., ordered from you for Washington University, has been received and used, and has given entire satisfaction.

J. J. REYNOLDS,
Prof. Mechanics and Engineering.

E. S. RITCHIE, Boston, Mass.

From John P. Gassiot, Vice-President of the Royal Society.

LONDON, March 7, 1859.

DEAR SIR: I have great pleasure in assuring you that the Induction Coil, which, through the introduction of my friend, Prof. Rogers, you constructed for me, answers most admirably. With five of Grove's Nitric Acid Battery Cells I obtain eleven and a half inch sparks. The Vibrating Contact Breaker, which you subsequently sent, has enabled me to repeat all the experiments with my Vacua Tubes, while the three divisions in your Coil affords facilities for varying the experiments in a manner that can be well appreciated by those who have worked with this apparatus.

Believe me, dear sir, yours truly,

JOHN P. GASSIOT.

To EDWARD S. RITCHIE, Boston.

Extract of Letter from Prof. Forbes of the University of Edinburgh.

EDINBURGH, 16th July, 1858.

MY DEAR SIR: * * * I have been highly pleased with the instrument. I have shown it in action to many scientific men, including Sir David Brewster.

I remain, dear sir, yours faithfully,

JAMES D. FORBES.

MR. RITCHIE.

SMITHSONIAN INSTITUTION,
WASHINGTON, D. C., April 4, 1860.

DEAR SIR: I am gratified on being able to inform you that the Inductive Apparatus you prepared for the Smithsonian Institution fully equals the account you gave of its performance. With three cups of Bunsen's battery it gives a spark of about twelve inches in length, and would probably give a longer one with a greater number of cups, or with those of a larger size.

Very respectfully, your obedient servant,

JOSEPH HENRY, *Secretary.*

E. S. RITCHIE, Esq., Boston.

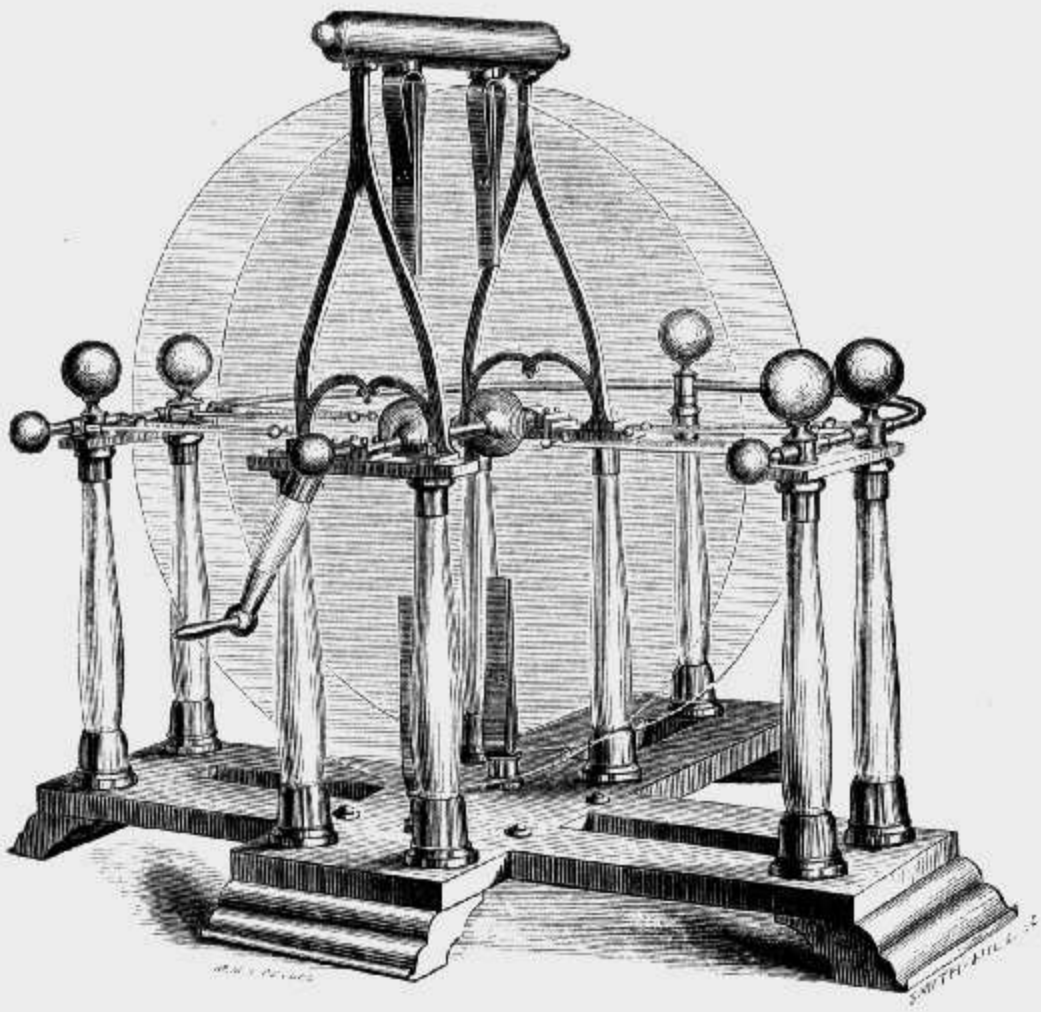
UNIVERSITY OF MISSISSIPPI, March 9, 1859.

The University of Mississippi has been, for several years past, a large purchaser of Philosophical Apparatus from the establishment of E. S. Ritchie, of Boston, portions of which have been taken from his general stock, and other and larger portions constructed expressly to order. In no instance has his work failed to give satisfaction.

Mr. Ritchie's success is, to a great degree, owing to the extent and accuracy of his scientific knowledge; but it is also scarcely less due to his practical skill in applying his knowledge, and with the scrupulous fidelity with which he aims to secure a uniformly good quality in all the articles which he permits to leave his establishment.

To investigators, the readiness with which he seizes the principle of a novel construction, and the fertility of invention with which he suggests the details necessary to its practical realization, render him an invaluable assistant and adviser. And to instructors, lecturers, and all others who have occasion to make use of scientific apparatus for any purpose, he will be found not only prompt and attentive in business, but judicious in adapting his constructions to the objects which they have in view.

F. A. P. BARNARD,
President of the University of Mississippi.



ELECTRICAL MACHINE CONSTRTCTED BY E. S. RITCHIE FOR THE UNIVERSITY OF MISSISSIPPI.

This machine is the largest ever made; the Plates are each *six feet* in diameter. The instrument is fi[illegible] most elaborate manner, and is mounted upon nine massive cut glass pillars [illegible] basement. A Prime Conductor of three cylinders with cut glass pillar[illegible], and a Battery of 100 Leyden Jars supported upon a table with a sing[illegible] pillar, accompany the instrument.

E. S. RITCHIE'S

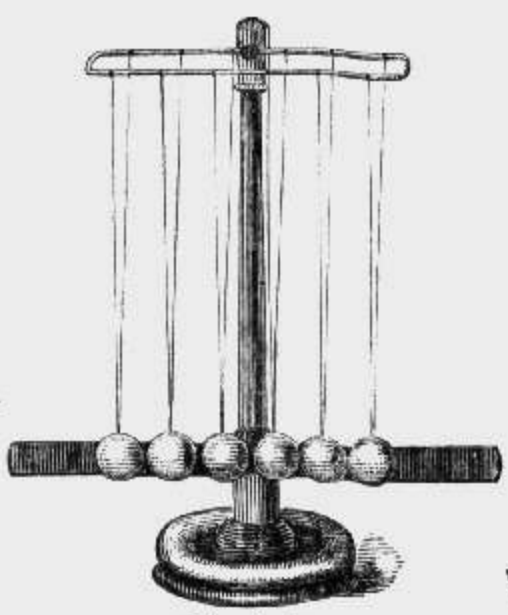
CATALOGUE.

LAWS OF MATTER AND MECHANICS.

No. 1.

No. 2.

No. 3.



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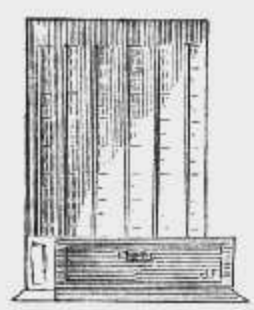
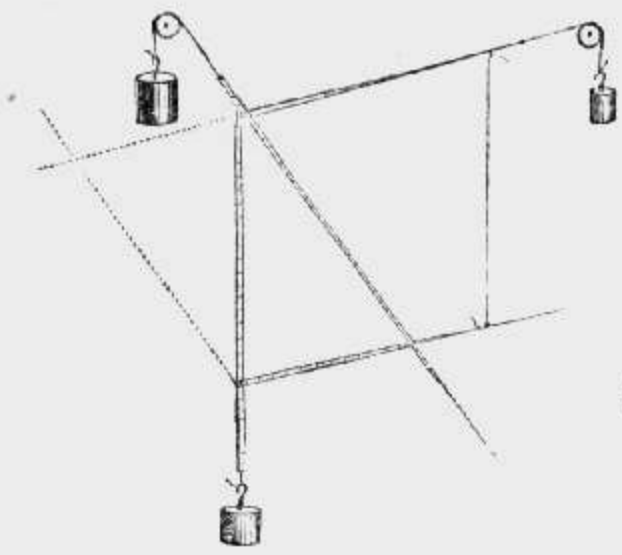


No. 4.

No. 5.

Number.		Price.
1.	A pair of Glass Plates for illustrating adhesion, ...	$1.00
2.	A pair of Lead Hemispheres, with brass handles, for adhesion, ...	75
3.	Inertia Apparatus; mahogany stand with spring and ball, ...	1.00
4.	Capillary Tubes; set of six, with stand and water pan, ...	1.25
5.	Capillary Plates, of plate glass, showing the hyperbolic curve, 1.00	2.00
6.	Set of Collision Balls, mahogany frame, with six $1\frac{1}{2}$ inch ivory balls suspended by two silk cords; graduated ebony arc, ...	7.00
7.	Collision Balls, the same, with six $1\frac{1}{2}$ inch lignum-vitæ balls, ...	4.00
8.	Collision Balls, mahogany stand, six $1\frac{1}{2}$ inch balls, single cord, ...	3.00
9.	Collision Balls; sets like Nos. 6 and 7, with balls graduated from $\frac{3}{4}$ to $1\frac{3}{4}$ inch, same prices.	
10.	Set of three Ivory Balls, $1\frac{3}{4}$, $1\frac{1}{2}$, and 1 inch, to attach to frame of No. 6,	2.50
11.	Set of four Lead Balls, with cords, ...	1.25



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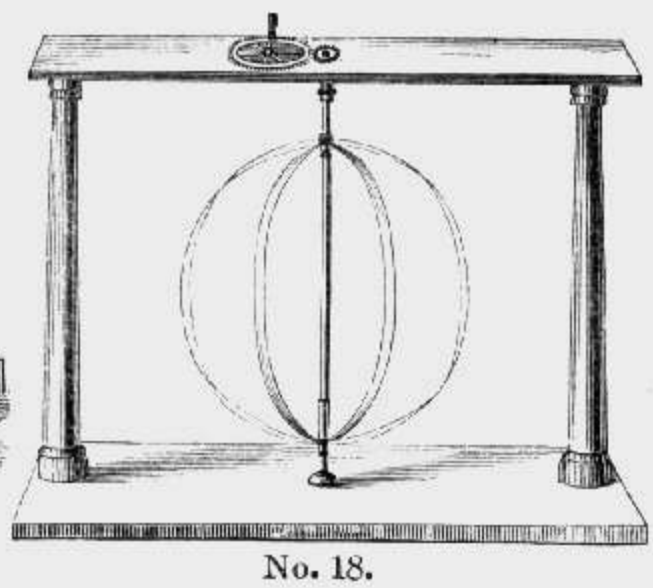

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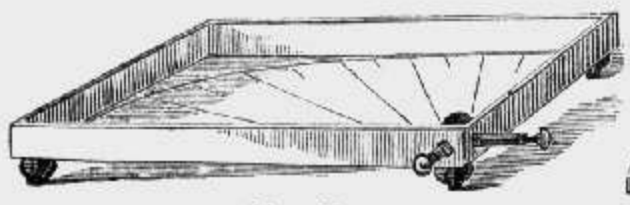
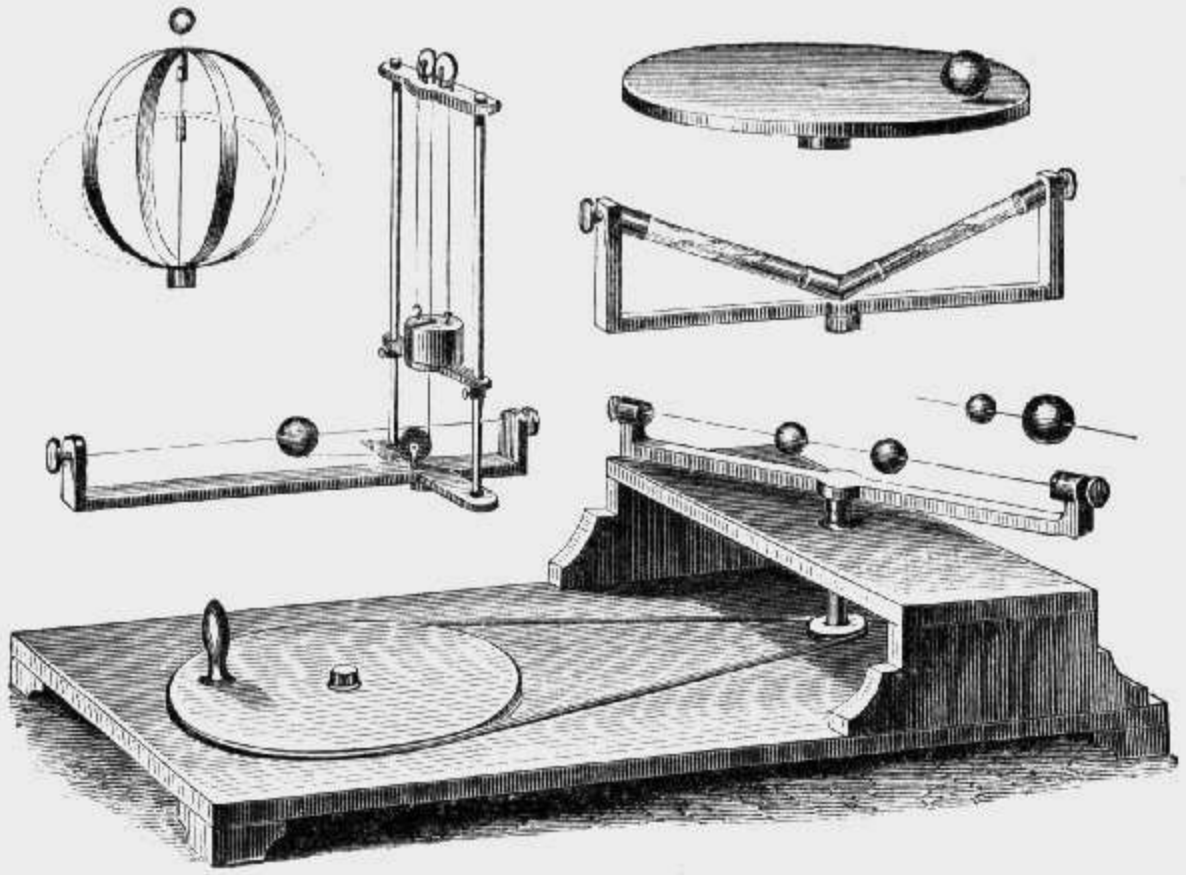


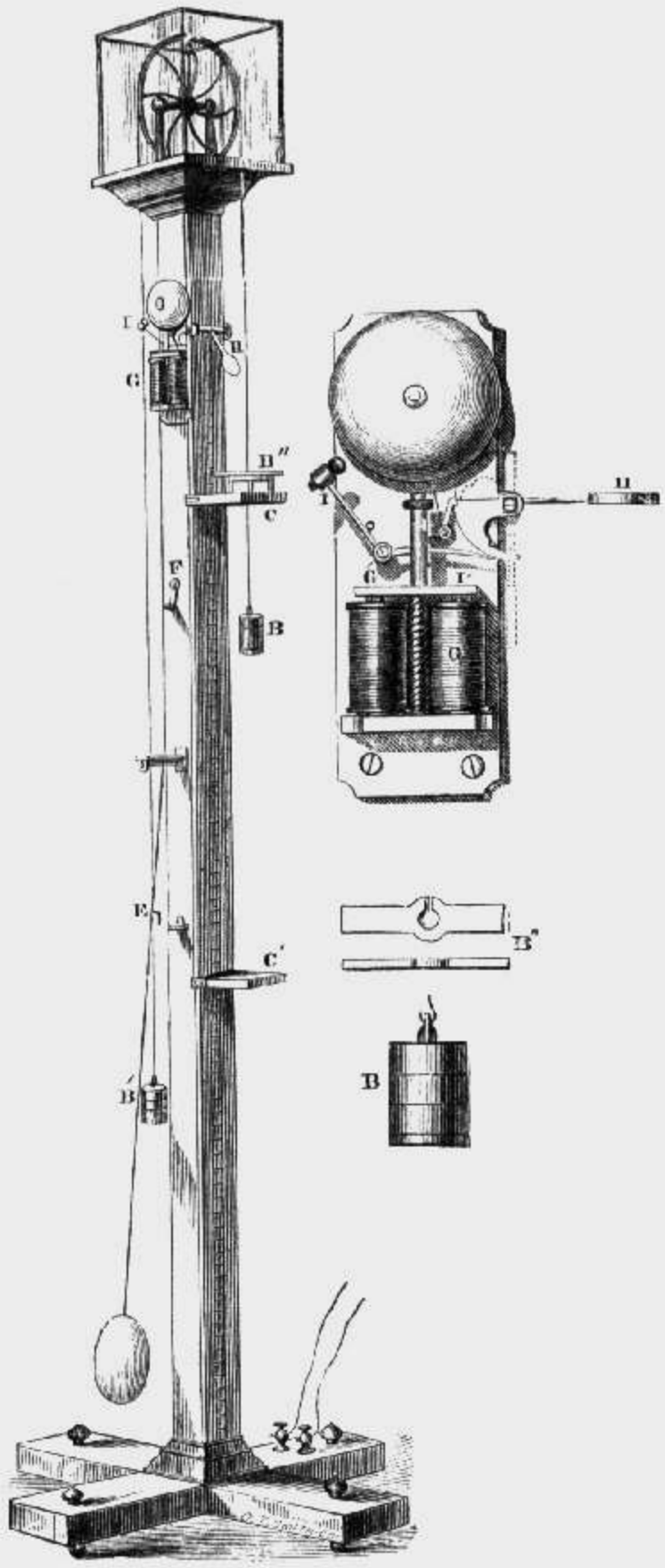
No. 13.

Number.		Price.
12.	Parallelogram of Forces; a light and strong graduated frame, with hinged joints, illustrating beautifully the composition and resolution of forces, with pulleys to attach to the frame of mechanical powers, or to the black-board,	$4.50
13.	Table with spring Pistols and Ball, for illustrating composition of forces,	8.00
14.	Set of eight Illustrations of Centre of Gravity, including three blocks with centres; two balls upon a rod with centre; leaning tower with two centres; loaded wheel on stand with centres of magnitude and gravity; double cone and inclined plane; horse balanced on a stand; with handles,	7.00
15.	The Waltzers; two little figures attached to a lens which rotates upon an inclined wet glass plate,	.75
16.	Model of a Scale with movable vernier,	1.50
17.	Marble Disc and Ivory Ball, to illustrate Elasticity; disc 10 inch diameter, ball 1½ inch,	2.00
18.	Whirling Machine; illustrating central and centrifugal forces, the flattening of the poles of the planets, the revolution of bodies on their shortest diameter; mahogany frame, 20 inches long by 18 high, brass geared wheels and movable spindle; with eight illustrations, viz. a double elastic brass ring, glass globe for mercury, &c., oblate and prolate spheres, cylinder, brass disc, brass ring, ring of chain,	8.00
19.	Whirling Machine, similar to No. 18, of larger size,	10.00
20.	Plate, twelve inches in diameter, with the prismatic colors, for recomposing white light to use with No. 18,	1.50



No. 21.

Number.		Price.
21.	Whirling Table, illustrating the effects of centrifugal force; mahogany table; steel shaft and pulley with driving wheel and winch. The shaft is furnished with a screw upon which are attached, —	
	1. A frame with a wire upon which are placed two balls of equal or of unequal masses.	
	2. A frame with inclined glass tubes for liquids of different specific gravity, as mercury and water.	
	3. A double brass elastic ring upon a spindle.	
	4. A Circular Table, with a ball which is secured by a cord and swivel to its centre; illustrating effects of *Inertia*.	
	5. An instrument for determining the centrifugal force; upon a wire, stretched on a frame, is placed a heavy brass ball; a cord attached to it passes under and over pulleys to a weight, which is placed in the line of the centre of motion, guided by two brass pillars: the weight is in several sections, so that a greater or less amount may be applied. The ball is secured to the cord by a binding screw, so that it may be placed at pleasure at different distances from the centre of motion, and the comparative force measured by the amount of weight raised.	
	6. A Circular Disc, with the prismatic colors; in this and other experiments the table can be placed upon its side,	$50.00
22.	Whirling Table; in form similar to No. 21, with a governor attached in such manner that in a series of experiments the same velocity, or that of two, three, or four times greater, may be with certainty obtained, and the great laws of centrifugal and central forces verified in a beautiful manner,	75.00



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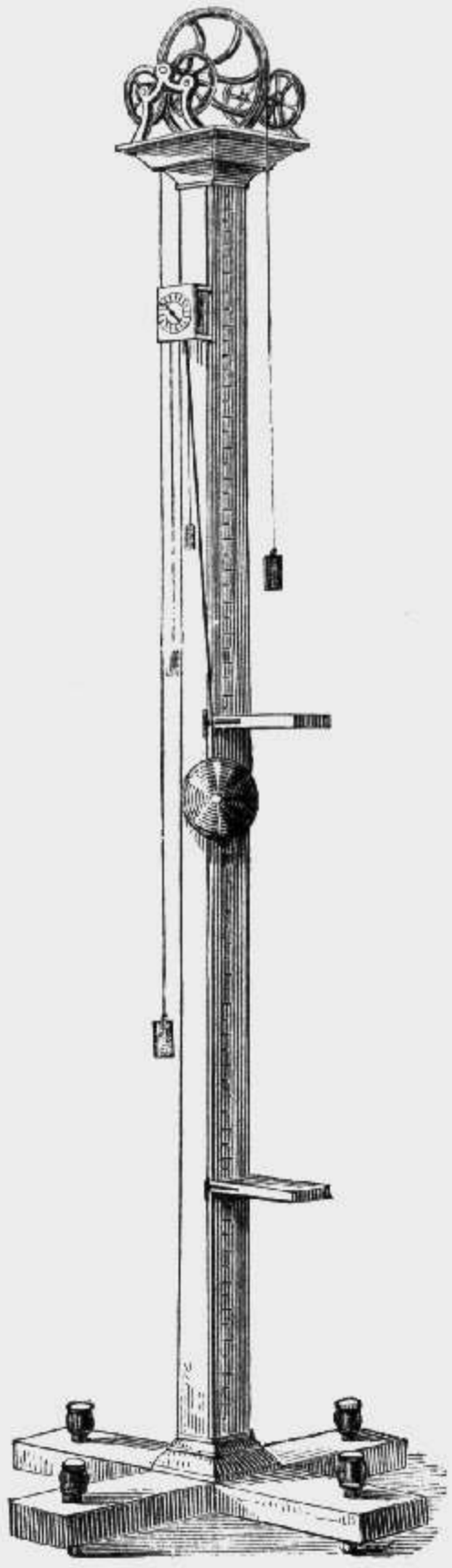
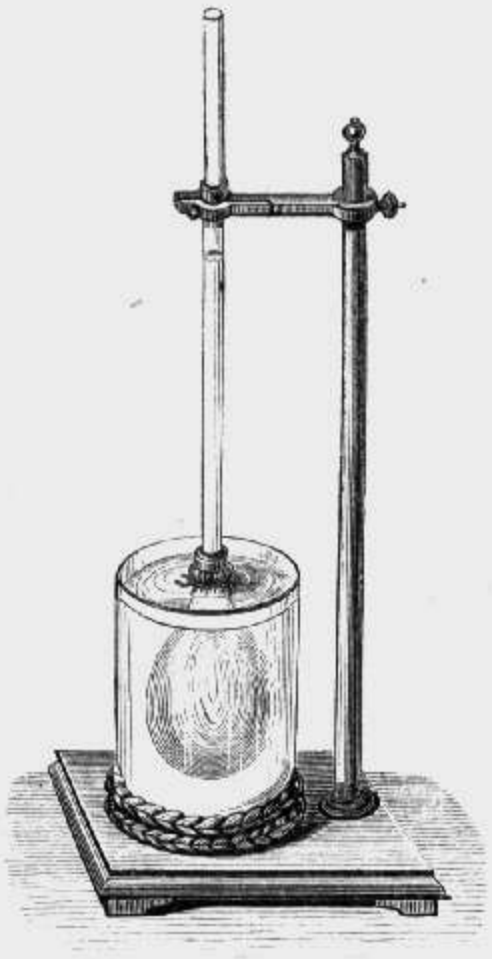


No. 26.

NUMBER.

23. Ritchie's Improved Attwood's Machine, with Electro-Magnetic Movement; mahogany pillar, with basement and levelling screws; pulley 9 inches in diameter, supported upon friction rollers or upon agate bearings; balanced weights made in three sections each of 1000 grs., with holder of 500 grs., making the total weight 7000 grs., or 1 lb.; sliding platforms. A point (E) upon a pendulum, which is supported upon the side of the pillar, passes, at the centre of each oscillation, through a drop of mercury, completing the circuit of a battery (one cell of Grove's), which gives an instantaneous motion to the armature of an electro-magnet (G). The *first* connection drops the



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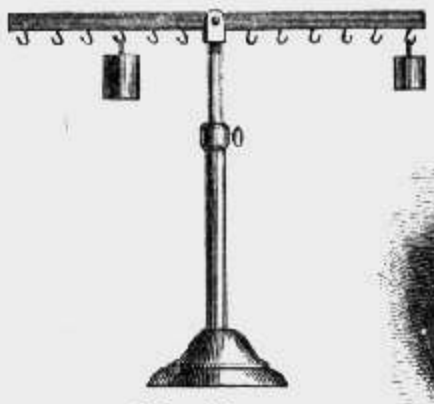

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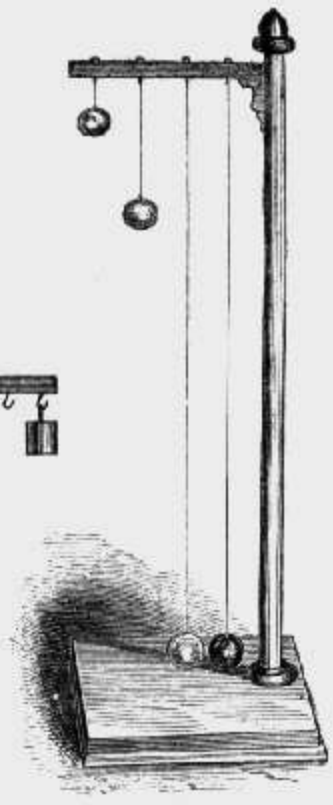


No. 30.

NUMBER. PRICE.

table (H) upon which one of the balanced weights (with the additional weight) (B'') rests, and each *subsequent* connection strikes a bell, marking the seconds of time during the experiment with the greatest precision. A sliding breakpiece (F) cuts off the current from the battery, until the experiment is ready to be performed,..$100.00

24. Ritchie's Improved Attwood's Machine; similar to No. 23, except that the large pulley is supported upon pivots, but in such manner as to run with nearly as little friction as with rollers. Every experiment illustrating the laws of falling bodies is performed with this instrument as perfectly as with the most elaborately constructed machine, 75.00

25. Attwood's Machine; graduated mahogany pillar, and basement with levelling screws, pendulum, sliding platforms, and set of weights,... 25.00

26. Attwood's Machine; similar to No. 25, with friction wheels,..... 50.00

27. Plate Glass Cover to either form of Attwood's Machine, ... 8.00

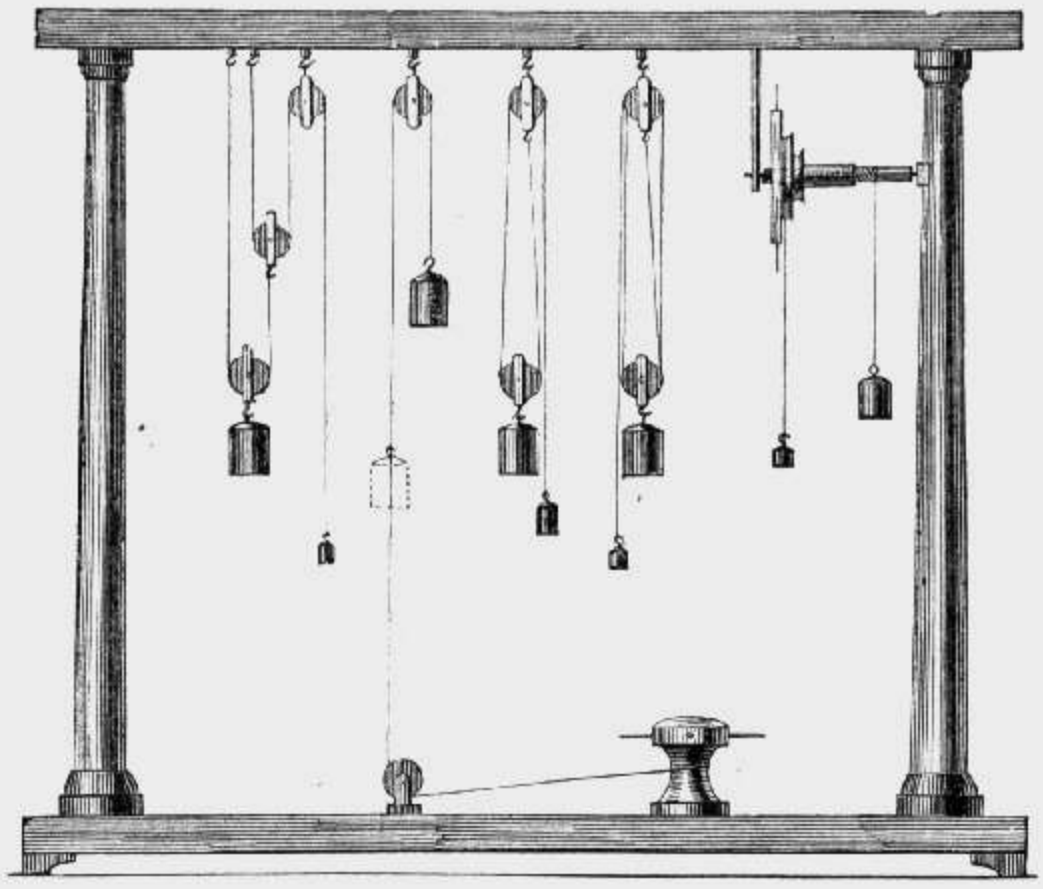
28. Endosmeter; mahogany base and pillar, with adjustable screw clamps; graduated glass tube and jar, ... 4.50

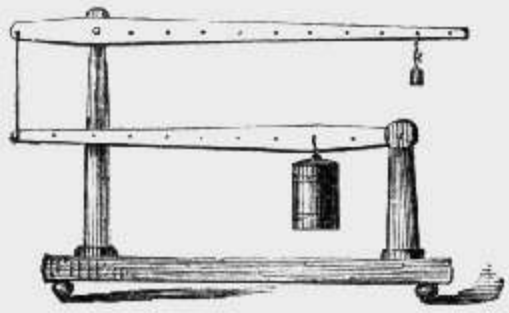
29. Endosmeter; graduated tube and bell glass to tie a membrane over,.. 1.75

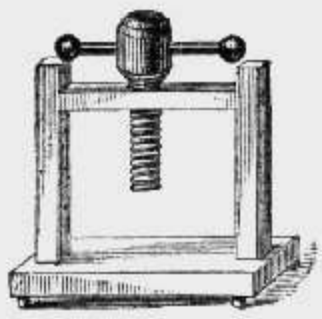
30. Illustration of the Pendulum; mahogany base and pillar; — an ivory and a lead ball, with silk cords of equal length; balls, with cords one fourth and one ninth the proportionate length, 6.00 and..... ..... 8.00

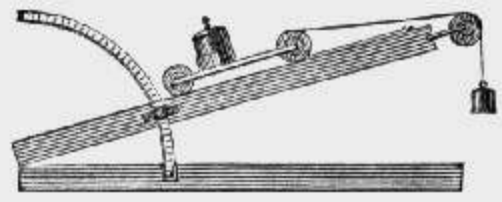
31. Set of Illustrations of the Lever; mahogany basements, brass pillars and frame; brass levers, balanced, twelve to eighteen inches; flat brass weights, two each of one, two, four, and eight ounces, four of sixteen ounces; with brass pulleys; illustrating the three kinds of levers; the whole highly finished and complete, ... 50.00

32. Illustration of the Lever, Balance, and Steelyard; brass adjustable stand, light and strong mahogany beam, with knife edges, and hooks for weights; two feet beam, 4.50; three feet do., ... 6.00









NUMBER PRICE

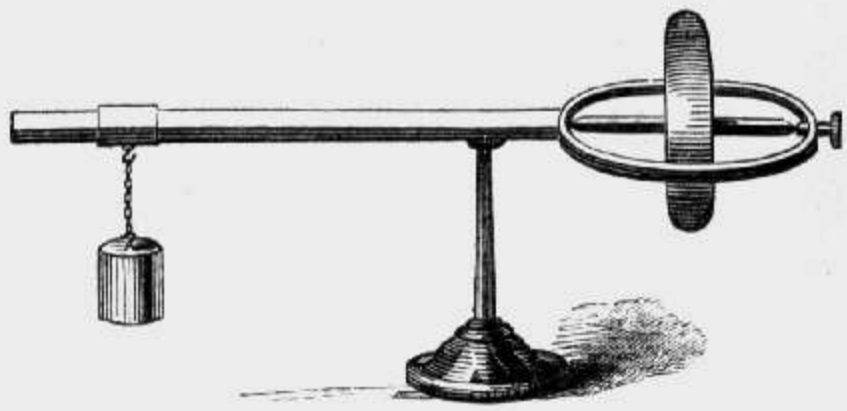
33. Mechanical Powers; mahogany frame 36 by 30 inches, with three sets of brass pulleys, balanced; wheel and axle; inclined plane and car; simple and compound levers; wedge in sections; ship's capstan; screw; and set of brass weights, ... 30.00

34. Mechanical Powers; polished mahogany frame 42 by 36 inches; four sets of large pulleys, with silk cords, balanced; wheel and axle; inclined plane with arc and binding-screw and car; simple and compound levers; wedge in sections; ship's capstan; screw with lever; screw as inclined plane; and set of brass weights, 1 to 32 ounces,.. 40.00

35. Mechanical Powers; polished mahogany frame; five sets of large pulleys balanced; wheel and axle upon a separate stand; levers of first, second, and third kinds, and compound levers, on stands; large screw with sliding lever; screw as inclined plane in frame; inclined plane and carriage of large size; wedge in sections; ship's capstan; with double set of brass weights,..... 50.00

36. Train of Geared Wheels; mounted in brass, with endless screw with large brass wheel, axle, and cylinder; complete,..... 25.00

No. 43.



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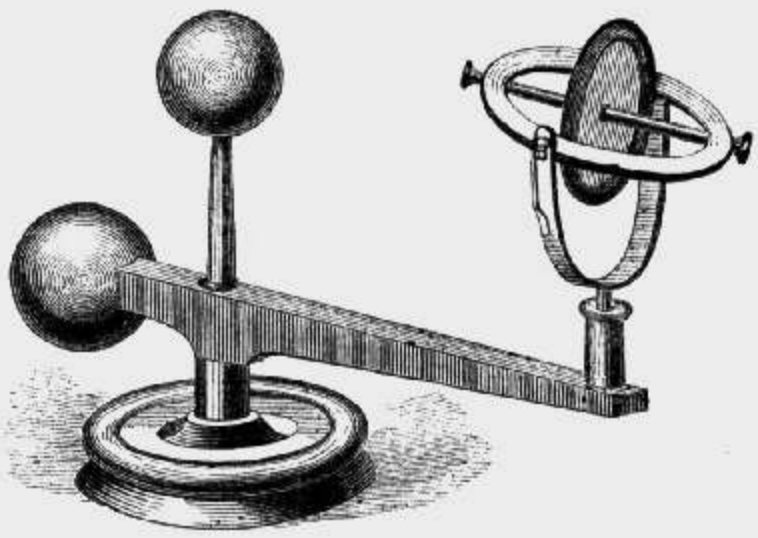
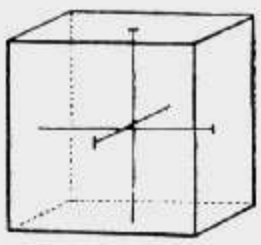


No. 41.

NUMBER		PRICE
37.	Gyrascope; brass wheel with ring, supported upon a point, ...	3.00
38.	Gyrascope; 3 inch brass wheel accurately balanced, with gimbal for the centre point; removable arm with sliding weight secured by a binding screw, ...	6.00
39.	Gyrascope; same as No. 38, with brass stand,.....	7.00
40.	Gyrascope; supported on gimbals, four and five inches diameter, accurately balanced, mahogany stand, 10.00 and	15.00
41.	Gyrascope; mounted on gimbals, and supported upon a balanced frame; the persistency of the wheel to revolve in the same plane as it is turned around the centre, beautifully shows the motions of the earth around the sun; a small weight attached to one of the axes, illustrates the *precession of the equinoxes;* brass wheel 4 inches diameter, ...	15.00
42.	Bohnenberger's Machine; 3 inch globe which revolves within three gimbal rings; mounted upon a stand; finely finished, 12.00 and....	15.00
43.	Plateau's Apparatus; a glass globe ten inches in diameter, with brass cap and stand; a shaft, crank, and movable disc. A quantity of oil is poured through a tube into the globe, which is filled with a mixture of water and alcohol of same specific gravity; it assumes a spherical form around the disc; by turning the crank the sphere becomes oblate, and finally portions are thrown off as *planets;* very beautiful and interesting experiments are performed, ...	6.00

CRYSTALLOGRAPHY, &c.



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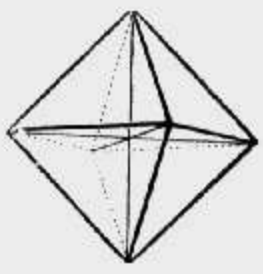

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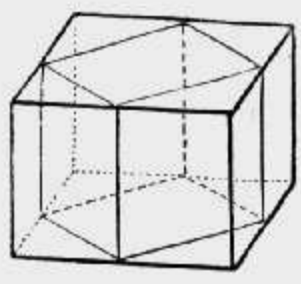

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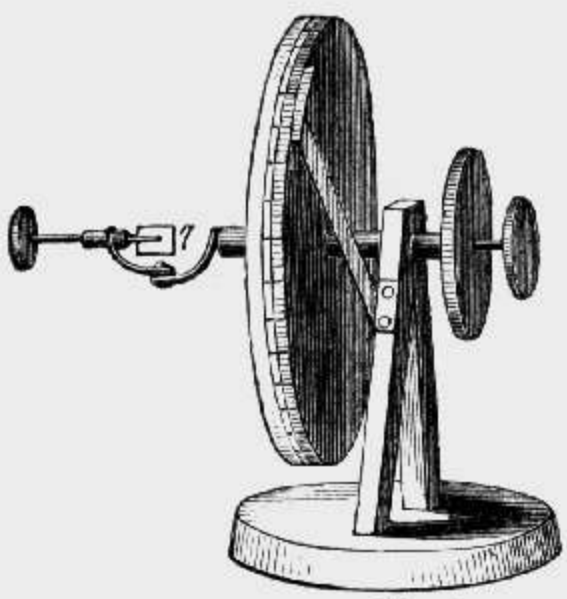

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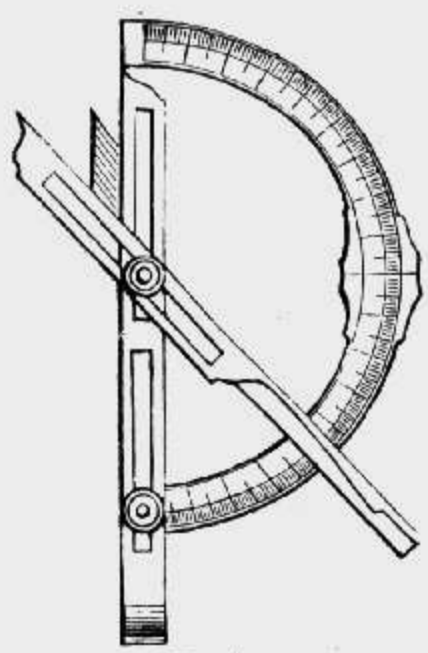
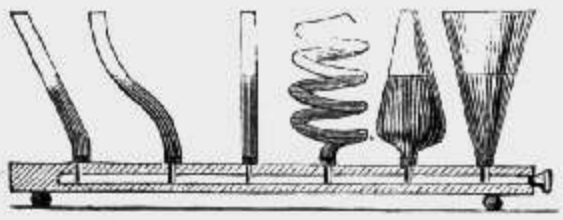


No. 4.

NUMBER.		PRICE.
1.	Models of Crystals; of solid glass, accurately ground and polished; eighteen pieces, giving the fundamental forms of crystals, in a case, 18.00 and.....	$27.00
2.	Models of Crystals of plain plate glass with threads representing their axes; in series of eighteen or of forty; or a series made to order, of any required number, and form, each,	1.00
3.	Wollaston's Reflecting Goniometer; brass graduated circle with vernier; finely finished,	25.00
4.	Goniometer, Hauy's; of brass, in box, 6.00 and	7.50
5.	Set of thirteen solids; viz. cube, cylinder, oblique cylinder, prism, six-sided prism, cone, pyramid, frustum of cone, frustum of pyramid, sphere, hemisphere, oblate spheroid, prolate spheroid,	1.00
6.	Set of Eight Mahogany Solids; illustrating cube root, plane, and solid measure, &c.,	1.25
7.	Set of Geometrical Solids, for Illustrating the Mensuration of Solids; ten cubes and parallelopipeds, papered,	1.25
8.	Dissected Cone; showing conic sections; the circle, ellipse, parabola, and hyperbola, 2.00 and	3.00
9.	Numeral Frame; with 120 balls,	1.00

HYDROSTATICS AND HYDRAULICS.



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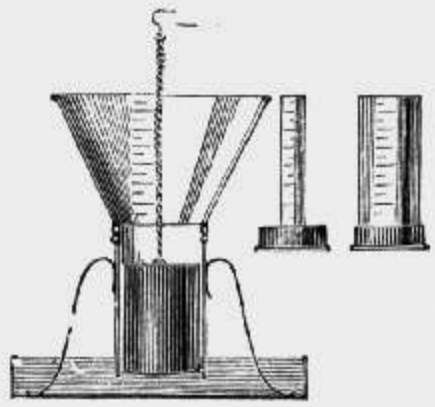

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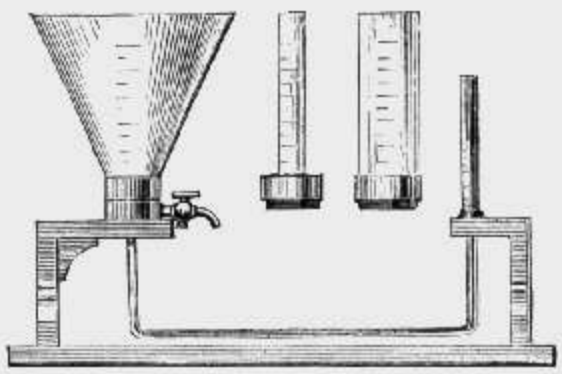

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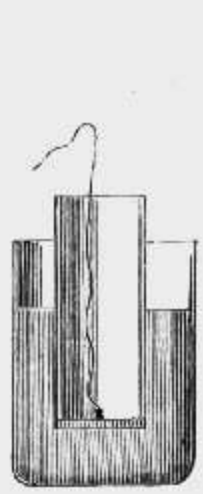

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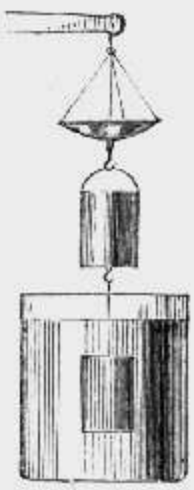
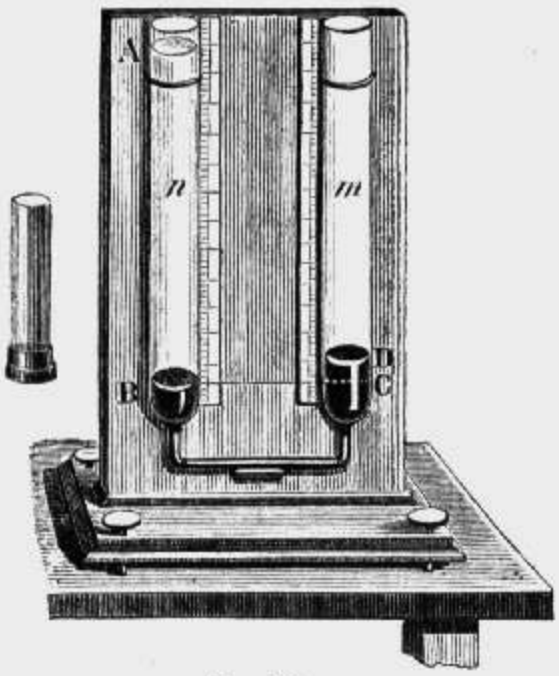


No. 6.

NUMBER.		PRICE.
1.	Equilibrium Tubes; a set of six forms with brass caps connected by screws to a brass tube mounted on mahogany basement, ...	$6.00
2.	Equilibrium Tubes; a set of six forms with brass caps; mahogany basement, ...	4.00
3.	Equilibrium Tubes; four forms with brass caps; mahogany base,....	3.00
4.	Apparatus illustrating the Upward Pressure of Liquids; a cylindrical glass jar, and a heavy brass plate with hook and cord, 2.00 and	3.00
5.	Apparatus to illustrate the upward and downward Pressure of Liquids; glass jar, with plate and ball; small size, 2.00; large size,.....	4.00
6.	Apparatus to illustrate the *Archimedes Principle;* brass cup and cylinder to attach to balance, 3.00 and	5.00
7.	Hydrostatic Paradox — Pascal's Apparatus; brass cylinder with plunger; three graduated glass vessels which connect with the cylinder by screw; caps; water-pan, 8.00 and	10.00
8.	Hydrostatic Paradox — Haldat's Apparatus; mahogany frame; bent glass tube for mercury; brass base with stop-cock; glass funnel and tubes with brass caps, ...	25.00

No. 9.



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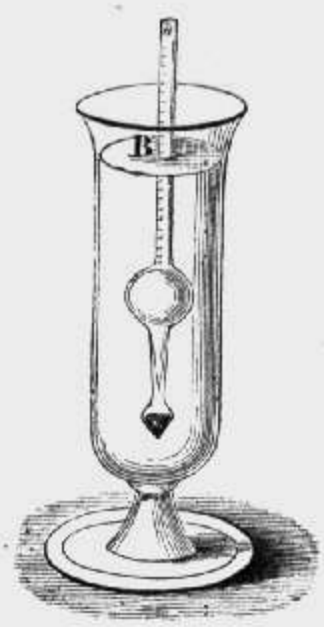
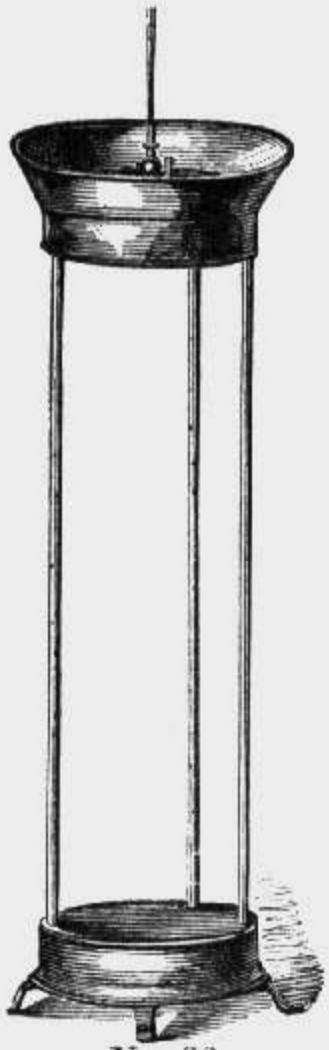


No. 12.

NUMBER.		PRICE.
9.	Hydrostatic Paradox — Masson's Apparatus; a glass jar with brass cap, to which may be screwed the graduated glass vessels; a cylinder of glass, two inches diameter, extends below the cap, its lower edge is ground to fit a brass plate which is attached by a cord to the balance. This form is much superior to either of the above, 15.00 and	$25.00
10.	Liquid Equilibrium Apparatus, for liquids of different densities; mahogany frame; graduated glass tubes, with iron sockets and tube,	6.00
11.	Hydrometers; graduated to Baumé's and others' scales for spirits, water, acid, &c., 1.00 and	1.50
12.	Glass Hydrometers, large size, zero or water mark in the centre of the scale; is adapted to all liquids,	2.00
13.	Hydrometer Jar; graduated with foot and lip; ten cubic inches, 1.25; twenty cubic inches, 1.50; thirty cubic inches, 1.75; fifty cubic inches,	2.00
14.	Nicholson's Hydrometer for Specific Gravity; of japanned iron,	4.25
15.	Nicholson's Hydrometer, of brass, fitted for substances heavier and lighter than water,	6.00
16.	Specific Gravity Balance; brass elevating stand; brass beam sixteen inches long, with knife edge; brass scale pans (See No. 67, *Pneumatics*).	12.00
17.	Specific Gravity Balance, similar to No. 16, with fine wood beam,	8.00
18.	Hydrostatic Balloon and Car in Jar; three sizes; fifteen inch jar, 3.00; eighteen inch, 4.00; and twenty-four inch,	5.00
19.	Cartesian Devil in Jar, with rubber,	1.50
20.	Spirit Levels; mounted in brass, and cases, three to fifteen inches, 1.50, 2.00, 2.50, and	3.00
21.	Brass Siphon and Suction Tube,	1.50
22.	Glass Siphon; 50 cents, with tube,	1.25
23.	Wurtemberg Siphon; of glass, 50 cents and	.75
24.	Glass Plate and Cord, to attach to balance illustrating Liquid Cohesion,	1.00



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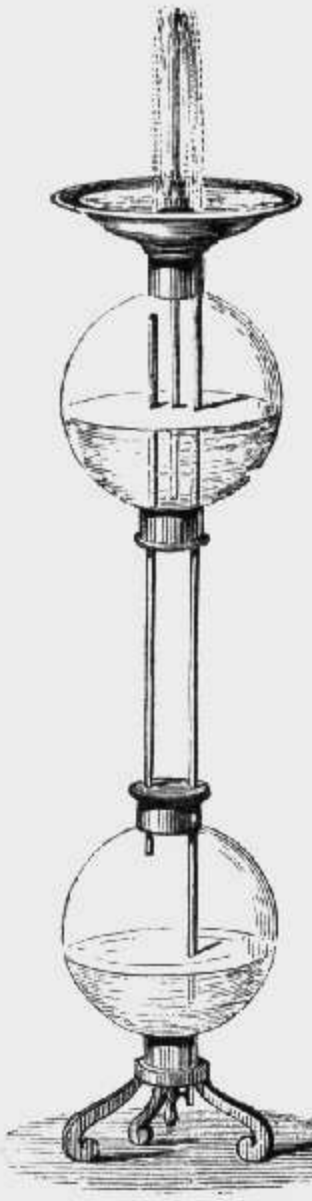

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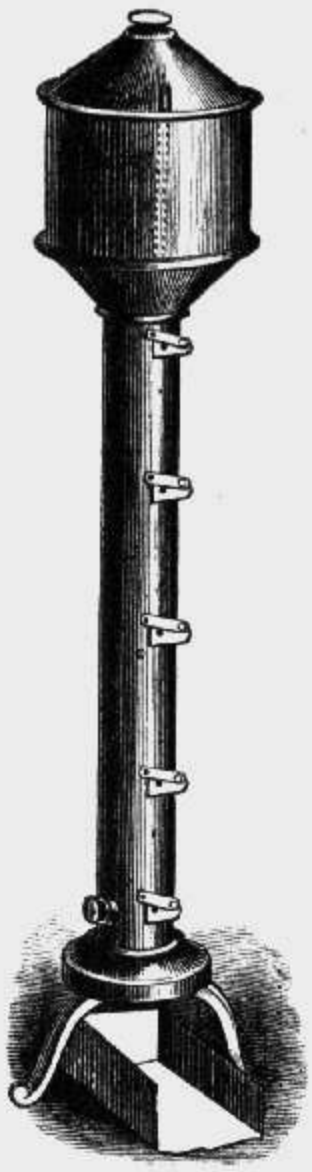
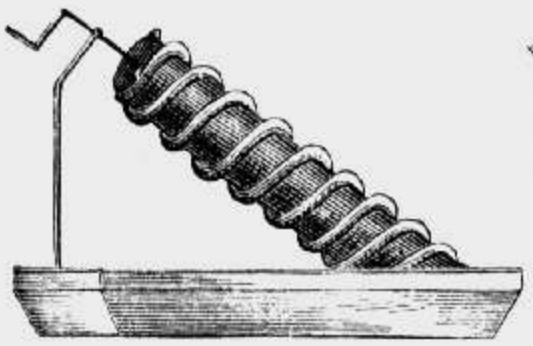


No. 28.

NUMBER.		PRICE.
25.	Hydrostatic Bellows, of improved form and construction; mahogany, twelve inches square, with patent leather sides lined with vulcanized rubber; brass socket and three-way water-cock; brass and glass tubes with brass screw connections; funnel,	$10.00
26.	Hero's Fountain; of copper, twelve inches diameter, forty inches high, with jet,	8.00
27.	Hero's Fountain; of glass, brass mountings,	15.00
28.	Spouting Fluid Apparatus, improved form; cylinder of brass upon a tripod stand; large copper vase with screw cover, fitted as a *Mariotte's Vase*, by which the water level is effectively constant, with five gates arranged so that the flow may be through orifices with thin sides or cylindrical or conical tubes, for Savart's experiments; a rod connects the gates, so that all, or any of them, may be opened and closed at the same moment; a horizontal tube with stop-cocks and jets; the apparatus is arranged for the beautiful experiment of the total reflection of light in a liquid vein (See *Optics*); a long copper cistern to receive the flow; the apparatus is very perfect and complete,	50.00

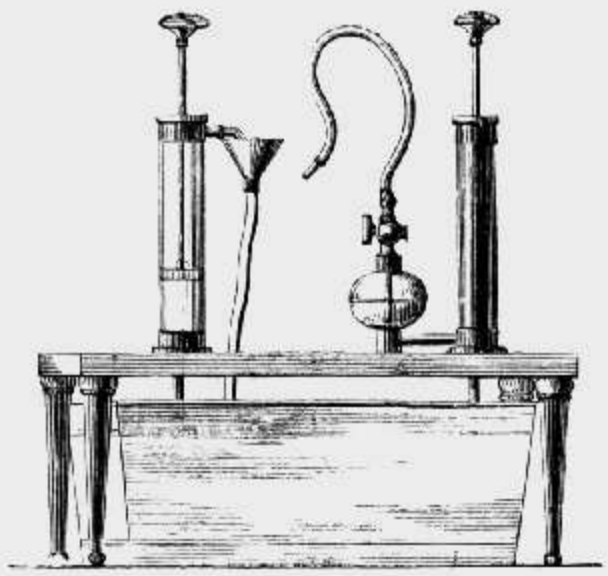


No. 30.

No. 31.

No. 33.

No. 34.



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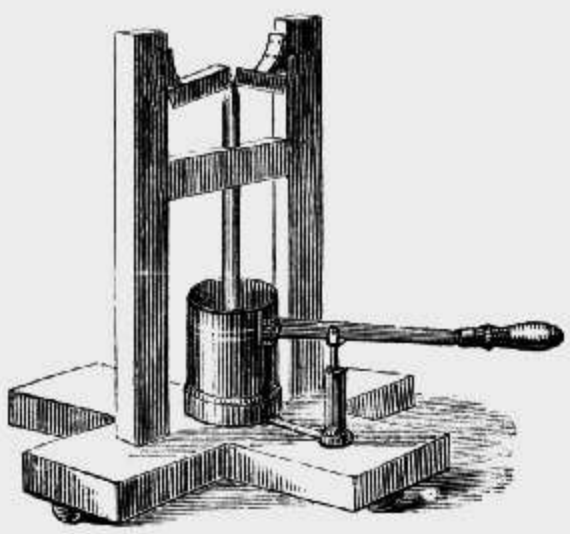
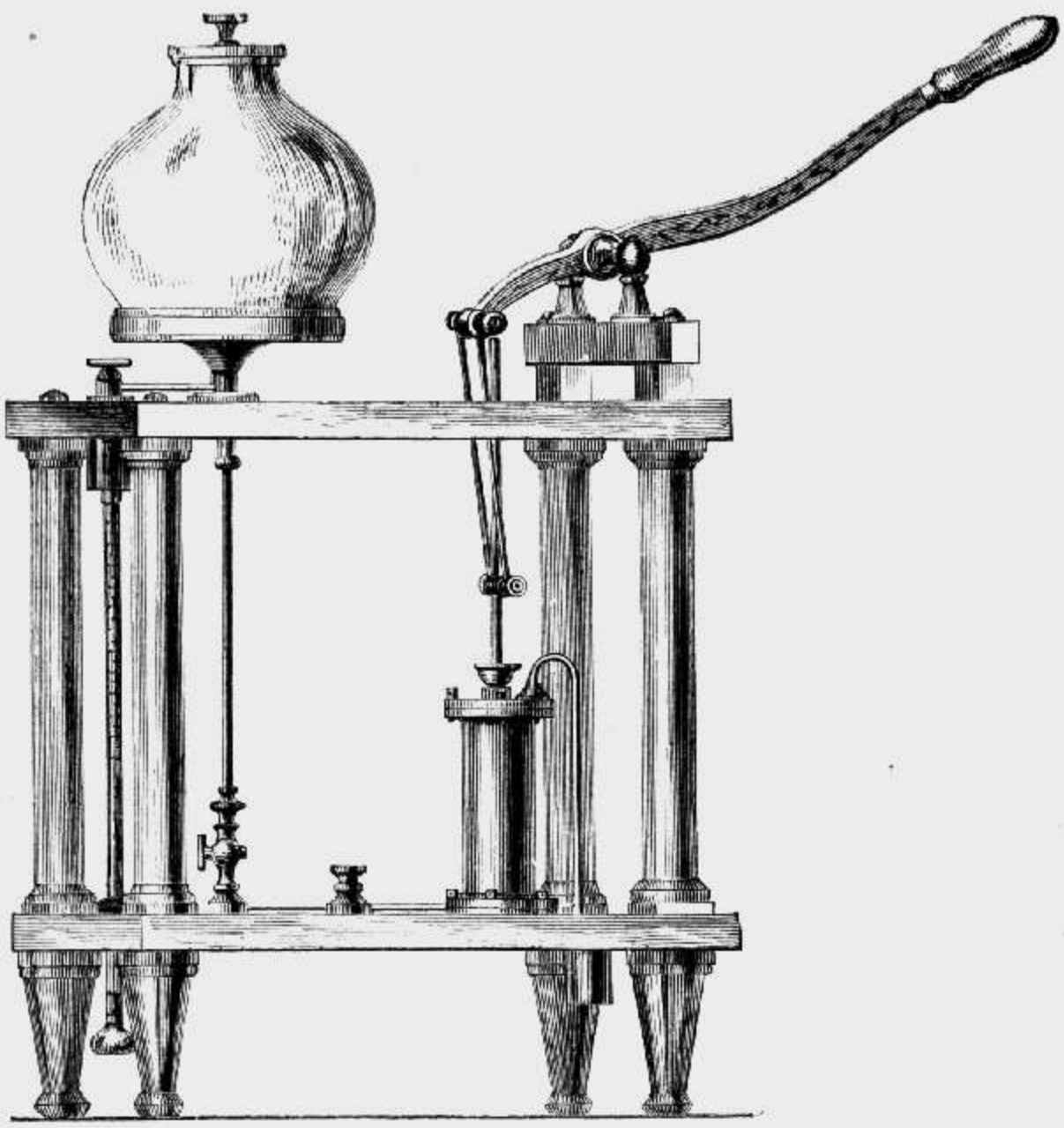


No. 38.

NUMBER.		PRICE.
29.	Spouting Fluid Apparatus, of common form; of copper, with cocks and jets, 15.00 and	$25.00
30.	Archimedes Screw Pump; with stand and cistern, 5.00 and	6.00
31.	Tantalus's Cup; illustrates intermitting springs, 1.50 and	2.00
32.	Glass Model of the Diving Bell; with lead ring,	2.50
33.	Glass Model of the Diving Bell; with cap and tube,	3.50
34.	Vacuum Siphon, or Fountain Siphon; glass globe with brass cap and tubes, 2.00 and	3.00
35.	Force Pump or Fire Engine; brass pump with glass air chamber; cock; hose with jet,	8.00
36.	Lifting Pump; glass barrel with stand, funnel and tube,	6.00
37.	Set of Water Pumps, including both force and lifting pumps, with stand and cistern,	12.00
38.	Model of the Hydraulic Press; improved form, with brass cylinder four inches in diameter, handsomely mounted on a strong frame, with force pump, jet, and water-pan; the power of the press is shown by breaking bars of cast iron and wood,	30.00
39.	Models of Water-wheels, Overshot, Undershot, and Breast-wheels; in frame, from 10.00 to	15.00
40.	Glass Model of the Centrifugal Pump,	15.00

PNEUMATICS.

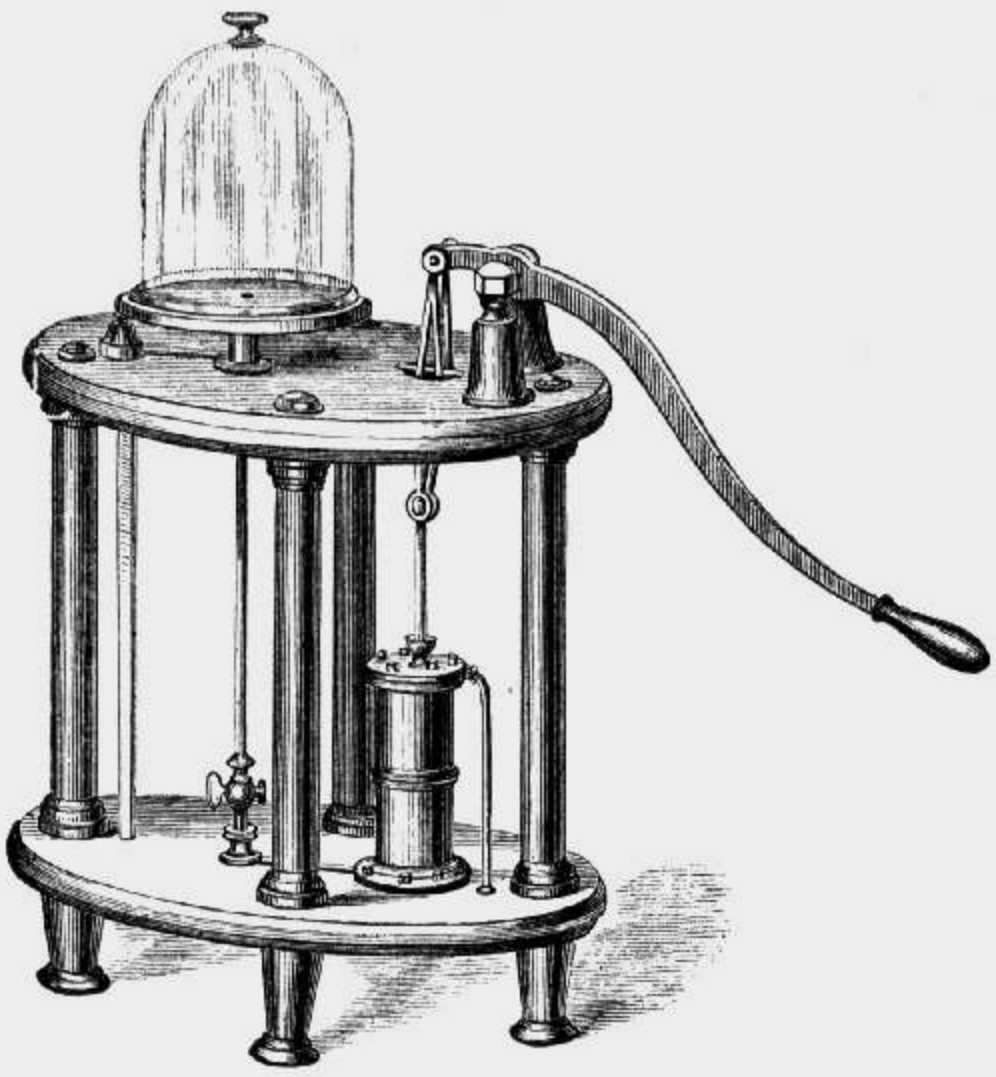


Nos. 1-4.

THE AIR PUMP.

The Leslie Air Pump, with lever and closed cylinder, has so great and acknowledged advantages over all others, that I make all my air pumps on this principle. In the mechanical construction I have made many valuable improvements, which, with the accuracy with which every part is constructed, renders the pump a very perfect, reliable, and durable instrument.

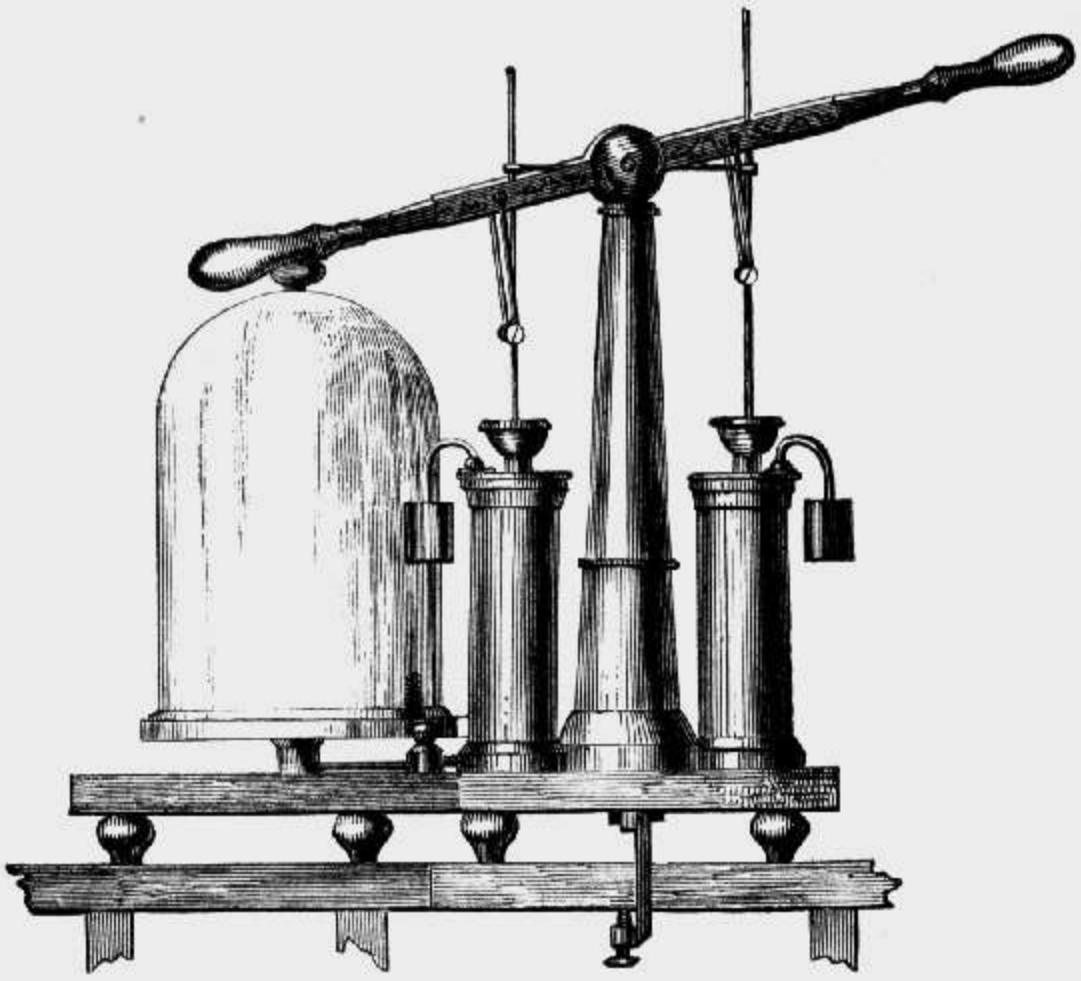
The cylinder is highly polished, the piston packed in an improved manner, insuring a perfect contact with slight friction; the piston-rod passes a stuffing-box in the top of the cylinder, which is of cup form, to receive oil, which renders the packing air-tight, and lubricates sufficiently the piston and rod.



No. 5.

The valve is of new and improved construction, remarkable for simplicity and delicacy, the ease with which it can be removed or changed, and the certainty of its action (Fig. A, page 15); it consists of a simple disc of oiled silk (*a*), kept in place by a pin at the centre (*b*); its extreme lightness insures a higher rarefaction than the heavy leather valves, and its flexibility causes it to hold always perfectly tight. The dome (*c d*) covering this valve can be removed by the fingers. The exit tube (*g*) passes from a channel made around the valve, directly down to a reservoir below the cylinder; oil cannot accumulate upon the valve, as in the old form. I have also remodelled the barometer gauge, rendering it impossible for the mercury to be drawn over into the pump, or for air to pass up the mercury column, as well as improving its appearance and strength: the inner tube dips into the mercury cistern, and is at its upper end turned downward, and drawn to a hair calibre, so that the mercury rises and falls slowly; the outer tube is of strong glass, and graduated; the space between forms a perfect mercury guard. The plate is of brass, finely ground. The frame is of best solid St. Domingo mahogany, finely polished, which, for beauty and durability and fitness, is almost universally preferred. I shall continue to make to order the frame of rosewood, which, though in many respects less desirable, will increase the cost from ten to twenty dollars. The use of cherry or maple, *stained in imitation of rosewood*, I have long since discarded; its *cheapness is poor economy*.

The brass work is highly finished, and the enamel lacquer used will preserve the polish, and retain its rich color for a long time. (See *Preface.*)



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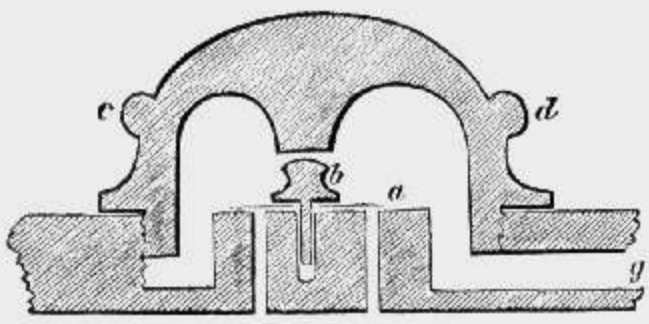
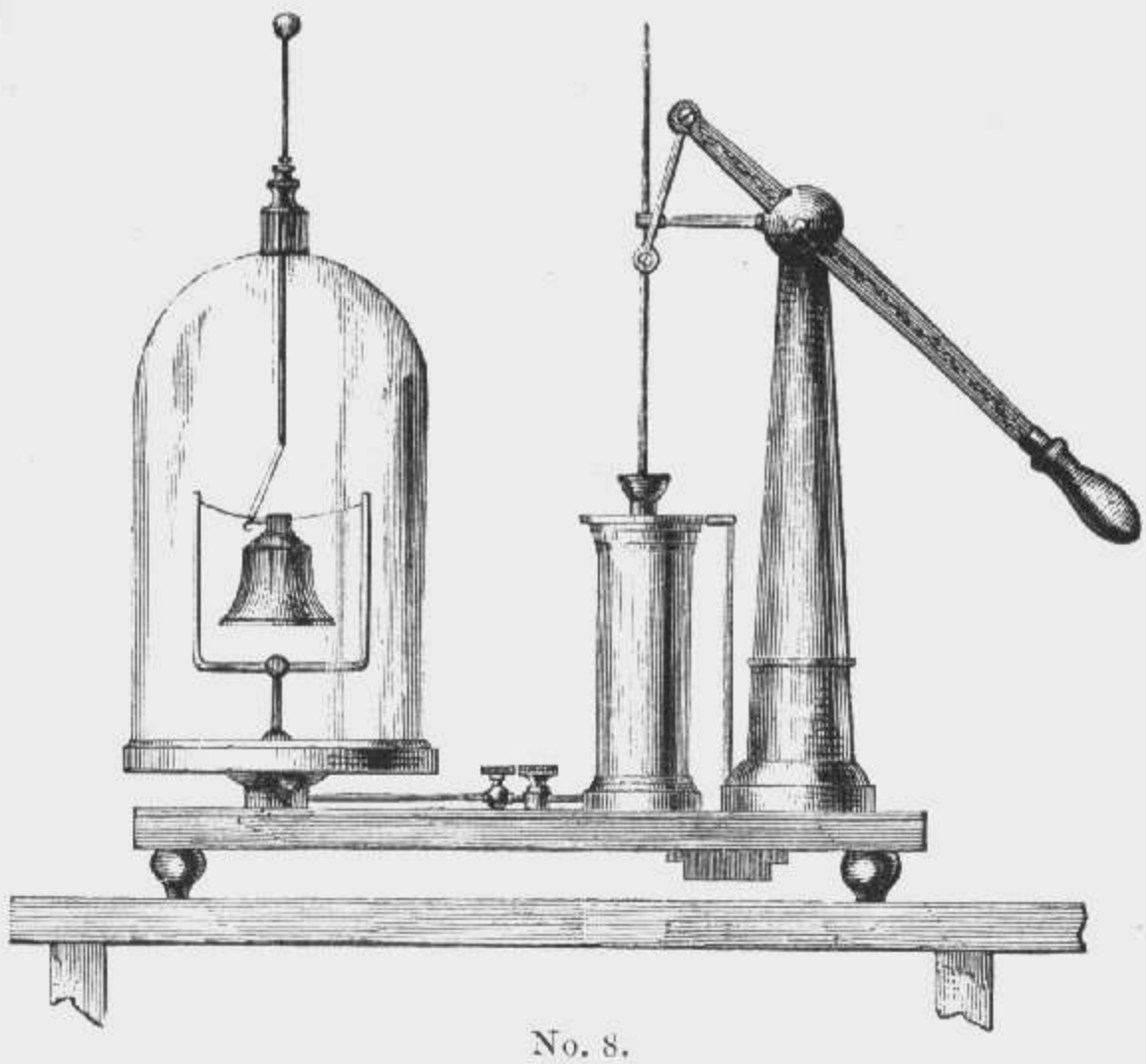


Fig. A.

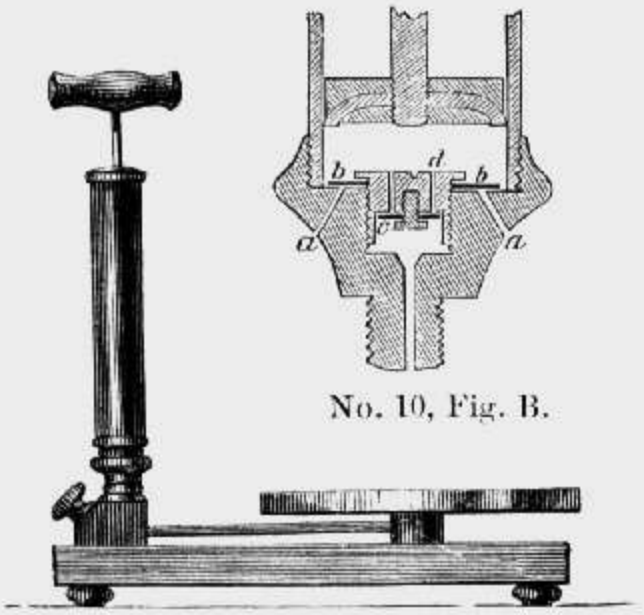
NUMBER.

1. Air Pump (Smithsonian); cylinder 13 by 4½ inches; plate 15 inches in diameter; improved barometer gauge; polished steel lever; frame of polished St. Domingo mahogany; finished in an elaborate manner,..... $200.00
2. Air Pump; cylinder 13 by 4½ inches; plate 15 inches; improved barometer gauge; the frame, of best St. Domingo mahogany, is 34 by 22 inches; the plate is elevated 48 inches from the floor; highly finished,..... 150.00
3. Air Pump; cylinder 12 by 3½ inches; plate 12 inches in diameter; improved barometer gauge; the frame is of finely polished St. Domingo mahogany, 31 by 19 inches; plate elevated 43 inches; highly finished. This size has been highly approved as a most convenient and efficient pump,..... 100.00



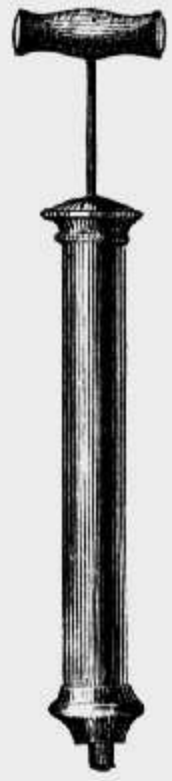
No. 8.

NUMBER.		PRICE.
4.	Air Pump; of same size and construction and as serviceable as No. 3; solid mahogany frame; thoroughly and neatly finished,	$85.00
5.	Air Pump; similar in every respect to No. 3, except frame of oval form,	115.00
6.	Air Pump; mahogany basements; two cylinders 7½ by 2 inches; plate 12 inches diameter. It has little advantage over a single cylinder pump,	40.00
7.	Air Pump; cylinder 7⅛ by 2½ inches; plate 12 inches diameter; mahogany basement 24 by 15 inches; plate elevated 6 inches from the table; highly finished,	40.00
8.	Air Pump; cylinder 7½ by 2 inches; plate 8 inches diameter; improved piston and exit valve, and tube; basement of mahogany, 20 by 14 inches; the plate is elevated five inches from the table; finely finished. As high degree of rarefaction is obtained as by any other size, and all experiments are well performed by its use,	25.00
9.	Air Pump; mahogany basement; cylinder 7 by 1½ inches, plate 6 inches,	12.00
9*a*.	Basement, with screw to fit pump-plate, stop-cock, and vent-plug. The plate from pump No. 1 to No. 5 may be removed from its frame and placed upon this basement upon the lecture table, and connected with the pump by a flexible hose.	
	With mahogany basement for 15 inch plate, 15.00; 12 inch do.,	10.00
	With marble basement for 15 inch plate, 18.00; for 12 inch do.,	12.00
	Flexible hose, with couplers, 8 feet, 3.00; 12 feet,	4.00



No. 9.

No. 10, Fig. B.



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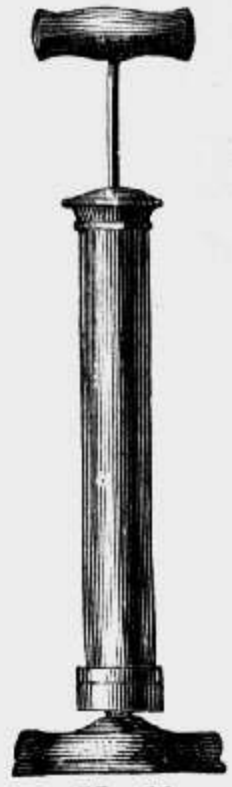

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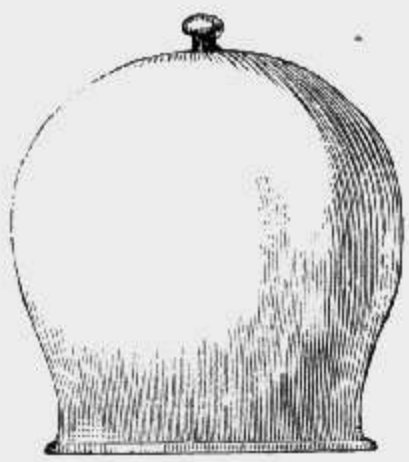
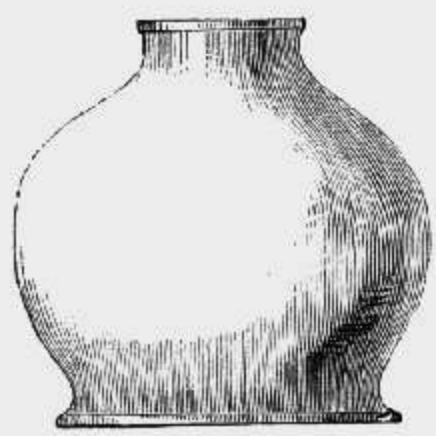


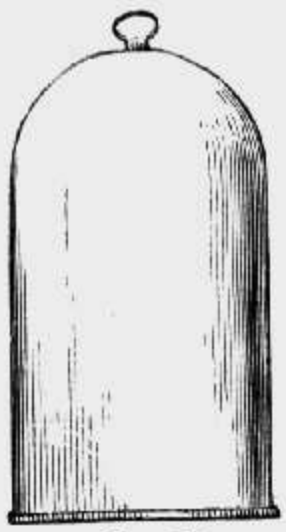
No. 12.

No. 13.



No. 14.

NUMBER.		PRICE.
10.	Ritchie's Improved Condenser; the cylinder is 7 by 1¼ inches; the base cap, which can be removed by the hand, is furnished with a screw (*d*, Fig. B), the flanch of which holds the inlet valve (*b b*) in place, while the exit valve (*c*) is secured in its lower end by a pin, — the valves are thus protected, yet readily accessible; both are of oiled silk, and hold perfectly tight, yet offer slight resistance to the air,	$6.00
10*a*.	Condenser with reversible piston and valve screw,	5.00
11.	Double Acting Condenser and Exhauster; changed by turning the base half round; the arrangement is troublesome and rarely holds tight,	8.00
12.	Swelled Bell Glass; five sizes; one gallon, 1.25; two gallons, 2.00; four gallons, 3.50; eight gallons, 7.00; ten gallons,	8.00
13.	Cylindrical Open Top Bell Glass; two quarts, 1.50; one gallon, 2.50; two gallons (the plate of the upward pressure apparatus covers these bells),	4.00



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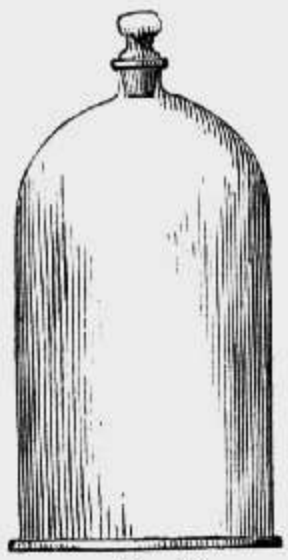

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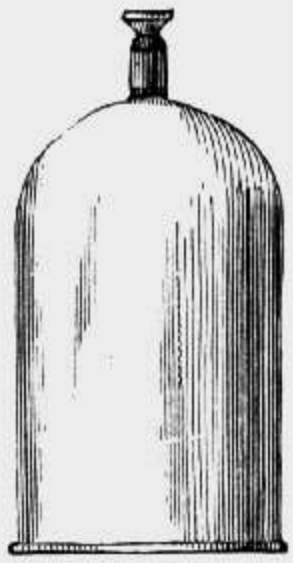


No. 17.

Nos. 19 & 20

No. 18.

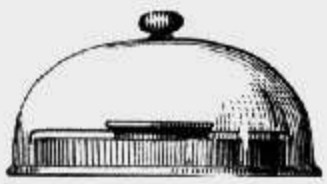
No. 21.

No. 22.

No. 23.

NUMBER		PRICE
14.	Swelled Open Top Bell Glasses, with glass covers; capacities, one gallon, 2.00; two gallons, 3.00; four gallons, 4.00; eight gallons, 8.00; ten gallons, 9.00; twelve gallons, ...	12.00
15.	Plain Bell Glasses; eight sizes; half pint, 30 cents; pint, 50 cents; quart, 75 cents; two quarts, 1.00; gallon, 2.00; two gallons, 3.00; four gallons, 4.00; six gallons, ...	5.50
16.	Bell Glasses with glass stoppers; eight sizes; half pint, 40 cents; pint, 60 cents; quart, 1.00; two quarts, 1.25; three quarts, 1.50; gallon, 2.25; six quarts, 2.50; two gallons, ...	3.50
17.	Bell Glasses, with brass screw caps, to receive a stop cock, connecter, sliding rod, &c.; six sizes; two quarts, 1.50; three quarts, 2.00; four quarts, 2.50; six quarts, 3.00; eight quarts, 3.50; twelve quarts,	4.50
	NOTE. — This is the most convenient form in use.	
18.	Straight Jars for four quart bell glasses, 75 cents; for eight quart,....	1.00
19.	Tall Bell Glasses; 18 by 4 inches, 1.50; 22 by 4½ inches, 2.00; 28 by 5 inches, ...	3.00
20.	Jars for do. (suitable for Hydrometer, &c.) 75, 1.00, and.	1.25
21.	Hand Glass, to show pressure of the air, for mercury tunnel, &c.,... .	.75
22.	Swelled Hand Glass, or Bladder Glass, ...	1.00
23.	Cupping Glass, with cap and stop cock,.....	1.50
24.	Bladder Cup and Cap, to use with condenser and condensing chamber, or under a bell glass; is used for the sheet rubber experiment, &c.; 3½ inch, 75 cents; 4½ inch, 1.50; with stand, ...	2.00
25.	Freezing Apparatus; bell glass, pan for acid, improved silvered water cup and stand; 6 inch, 2.50; 8 inch, 4.00; 10 inch, 5.00; 12 inch, 6.00; 15 inch, ...	8.00

No. 24.



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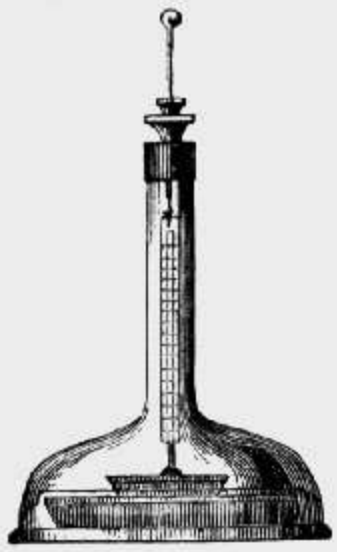


No. 27.

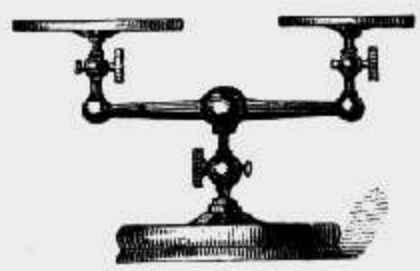
No. 50.

Nos. 31–34

No. 36.

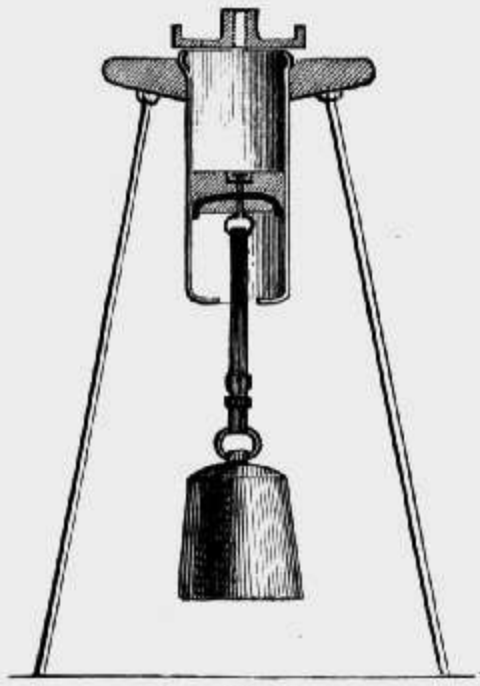
No. 37.

No. 40.



No. 41.

NUMBER.		PRICE.
26.	Freezing Apparatus; bell glass and acid pan with five or seven silvered water caps; 10 inch, 6.00; 12 inch, 7.00; 15 inch,	$8.00
27.	Freezing Apparatus; bell glass with brass cap and acid pan, with spirit thermometer to use with sliding rod; 8 inch,	7.00
28.	Freezing Apparatus; bell glass with brass cap, acid pan, water cup, funnel, stop-cock, and tube; 8 inch,	5.50
29.	Bell Glass, with glass bulb and tube, and spirit thermometer; for freezing mercury by the cold produced by the evaporation of ether,	6.00
30.	Magdeburg Hemispheres; six inches diameter, very heavy and strong; stop-cock, handles, and stand; highly finished,	10.00
31.	Magdeburg Hemispheres; five inches diameter, of extra thickness and highly finished, with mahogany stand,	7.00
32.	Magdeburg Hemispheres; 3½ inches diameter, of extra thickness and improved construction; with mahogany stand,	6.00
33.	Magdeburg Hemispheres; 3½ inches diameter; the handles and stop-cock of brass; the hemispheres of iron, less liable to injury in use; handsomely finished,	5.00
34.	Magdeburg Hemispheres; 2¾ inches diameter; brass handles and stop-cock; mahogany stand; with brass hemispheres, 4.50; with iron,	3.50
35.	Stand, Lever, and Fulcrum; used with Magdeburg Hemispheres for weighing a column of air,	5.00
36.	Inertia Wheel; vanes, which are placed edgewise or crosswise, on axle, 50 cents, and	1.00
37.	Revolving Jet and Stand, 1.00 and	1.25
38	Double Revolving Jet; revolves in opposite directions,	2.00

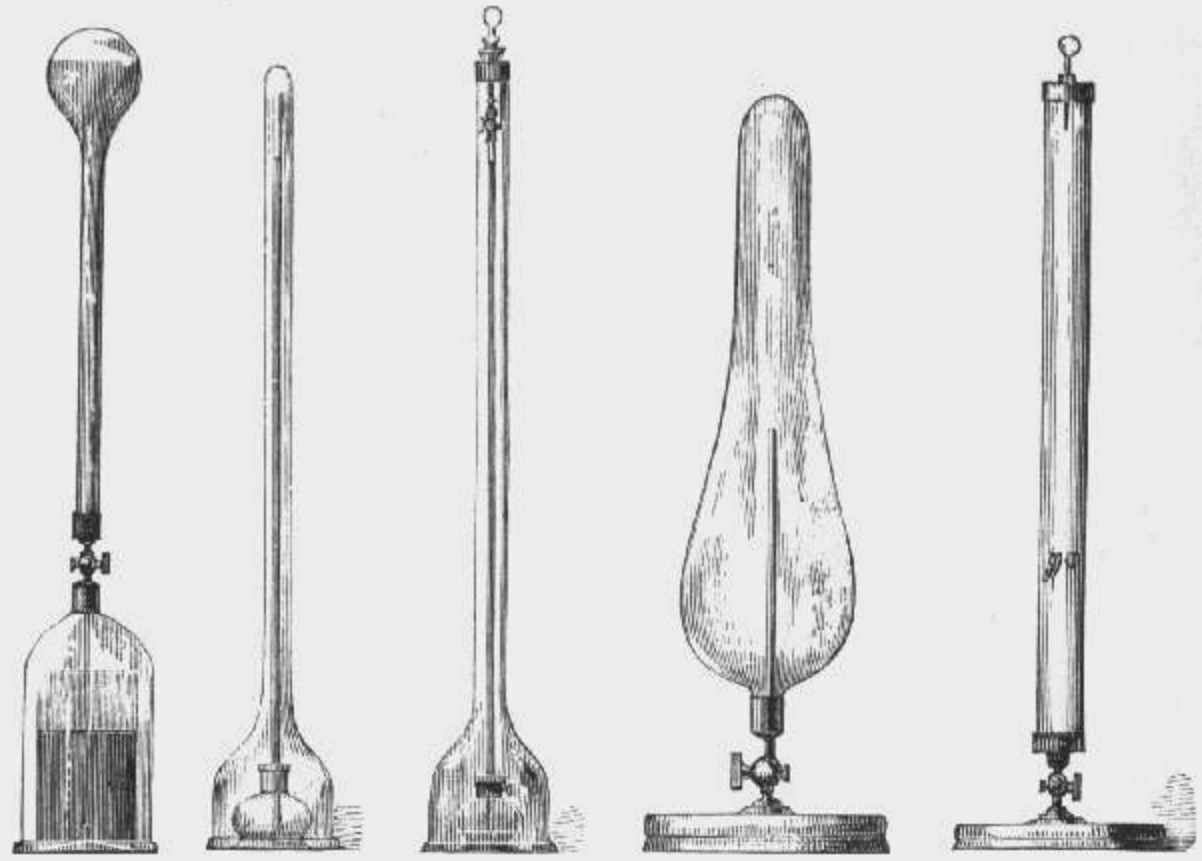


Nos. 42–45.

No. 46.

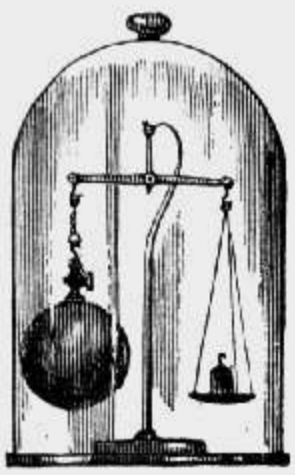
No. 48.

NUMBER		PRICE
39.	Bell for Vacuum, with stand; the bell is entirely insulated, 1.25, ...	2.50
40.	Brass Plate and Wood Cylinder, illustrating the porosity of wood, pressure of air, &c., ...	1.00
41.	Double Transferrer, with five inch plates, eight inch bar, three stop cocks, on stand,.....	10.00
42.	Upward Pressure Apparatus; tripod stand, 3 feet high, glass cylinder, 12 by 4½ inches, with piston, 5 inch brass plate, and strap for connecting weight, ...	10.00
43.	Upward Pressure Apparatus; tripod stand, 30 inch, cylinder, 10 by 3½ inches, 4 inch brass plate, and strap, ...	7.00
44.	Upward Pressure; tripod stand, 30 inch, cylinder, 9 by 3 inches, brass plate, 3½ inches, and strap,.....	6.00
45.	Upward Pressure; stand 26 inch, cylinder 8 by 2¾ inches, plate and strap,.....	5.00
	NOTE. — These illustrate also downward or lateral pressure and the elasticity of air, and are strong and durable.	
46.	Upward Pressure Apparatus; glass bell; brass cap, with India rubber bag to which weights are attached; tripod stand and strap,.....	6.00
47.	Lungs Glass; illustrating the mechanical action of the lungs, 2.00 and.....	3.00
48.	Cryophorus in Vacuo; with brass plate and bell glass; the water is frozen in the outer ball, from the condensation of the vapor in the ball within the bell glass, 5.00 and	6.00
49.	Flexible Water Hose, with screw and jet, ...	1.00
50.	Tunnel, Stop Cock, and Jet, for introducing mercury, acid, ether, alcohol, water, &c., into an exhausted bell glass, 1.50 and.....	2.00
51.	Apparatus for exploding gunpowder in vacuum; used also for other purposes; 3.00 and	4.00
52.	Lock for striking flint and steel in vacuum, 2.00 and.....	3.00



No. 53 & 54. No. 55. No. 56. No. 57. No. 59.

NUMBER		PRICE.
53.	Bolt Head with Brass Cap; 24 inch, 1.00; 30 inch,	$1.50
54.	Bolt Head with Cap, Stop-Cock, and Tube; 30 inch,	3.00
55.	Barometer Apparatus; bell glass 33 inches high; graduated glass tube with brass screw cap, mercury cistern,	3.50
56	Barometer Apparatus; bell glass, with sliding rod; graduated tube with hook; mercury cistern,	6.00
57.	Fountain in Vacuum; improved, heavy glass receiver with stop-cock, jet, and mahogany stand; 15 inch, 4.00; 20 inch, 5.00; 26 inch,	6.00
58.	Guinea and Feather Apparatus; with tall conical receiver, with sliding rod, plate, drop tables, &c.; 3 feet, 7.00; 4 feet,	10.00
59.	Guinea and Feather Tube; improved, capped at each end, with stop-cock and stand, and made heavy and strong for showing the resistance of condensed air, fitted for Aurora Tube for electricity; 2½ feet, 5.00; 3 feet, 6.00; 4 feet,	7.00
60.	Guinea and Feather Tube; heavy glass tube, with brass caps and mahogany base, with stop-cock on the upper cap for exhausting through a hose, fitted with ball and point for Aurora Tube; 4 feet, 8.00; 5 feet 8.50; 6 feet,	9.00
61.	Brass Cylinder and Piston, with weight, to illustrate the power of expanding air,	4.00
62.	Glass Balloon and Car, in glass jar, three sizes; 15 inch jar, 3.00; 18 inch, 4.00; and 24 inch,	5.00
63.	Hydrostatic Balloon; small rubber bag, to use in tall bell and jar,	1.25
64.	Bell Glass; graduated to cubic inches for measuring air or gas for weighing; capacity, 200 cubic inches,	3.00
65.	Graduated Bell Glass, as above; 100 cubic inches, with cap,	2.00



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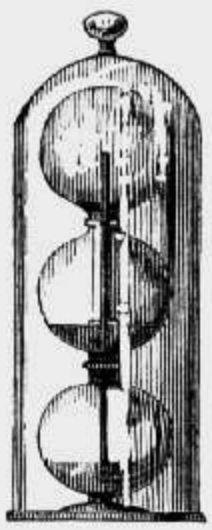

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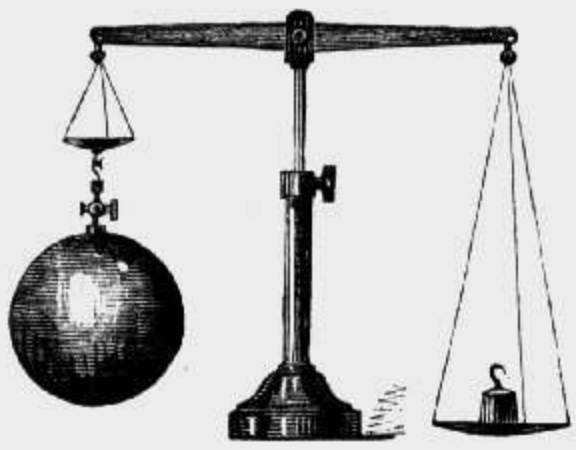

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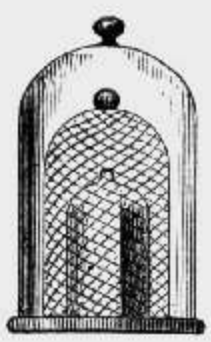
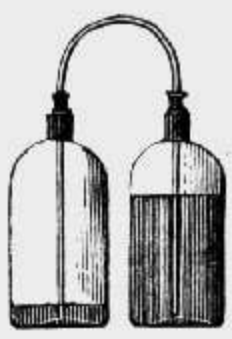


No. 71 & 72.

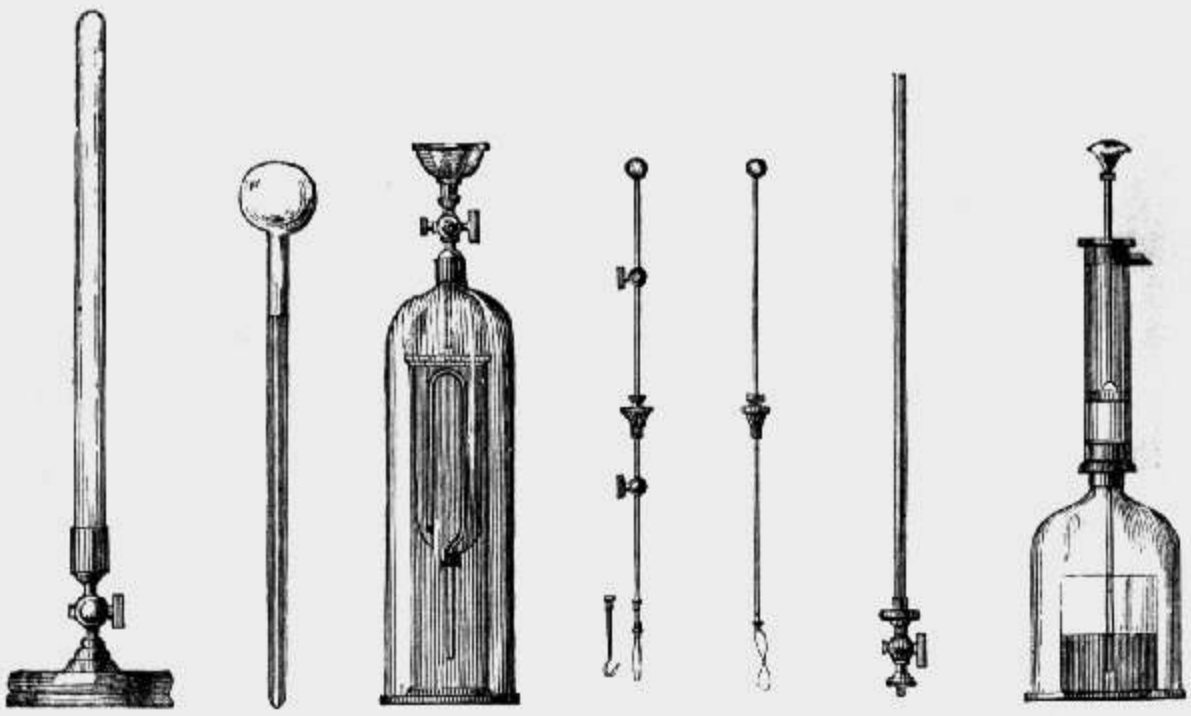
No. 74.

No. 75.



No. 77.

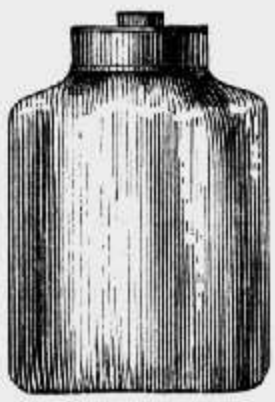
NUMBER		PRICE
66.	Weight and Buoyancy of Air Apparatus; three inch globe with stop-cock and hook; a very sensitive steel balance, with brass support and mahogany stand; a box of oz. and gr. weights and scale pans and counterpoise weights; the balance and weights suitable for other uses,	$6.00
67.	Balance and Globe for weighing Air and Gas; brass beam sixteen inches long, with steel knife edges; a brass elevating stand with binding screw; scale pans fitted for *specific gravity;* copper globe six inches diameter, with stop-cock and hook,	15.00
68.	Balance and Globe for weighing Air; steel beam balance, brass support and stand, fitted for specific gravity; five inch globe and stop-cock,	12.00
69.	Globe and Stop-Cock for weighing Air; of polished copper; four inch globe, 3.50, six inch globe,	5.00
70.	Treble Globe or Liquid Transferrer; to be used under a bell glass,	3.00
71.	Mercury tunnel; for showing the porosity of wood, 75 cents and	1.00
72.	Bursting Squares; for expansion or pressure; per dozen, boxed,	1.50
73.	Wire Guard, for bursting squares,	.75
74.	Brass Cap and Valve, for bursting squares,	.25
75.	Expansion Apparatus; bell glass, bolt head, and jar; with pint bell, 75 cents; with quart bell,	1.00
76.	Siphon Vacuum Gauge, in glass case, with stand,	2.50
77.	Bacchus Illustration; glass globes, with caps and tube, 1.50 and	2.00



No. 78. No. 79. No. 81. No. 83. No. 85. No. 86. No. 91.

NUMBER		PRICE
78.	Water Hammer; strong glass tube, with brass cap, stop cock, and stand, (for exhaustion,)	3.00
79.	Water Hammer; tube, hermetically sealed,	1.00
80	Flexible Rubber Hose; with brass screws to attach to pump; for Nos. 42, 60, 78 &c.; 3 feet, 1.50; 4 feet,	2.00
81.	Siphon in vacuum, with capped bell glass, tunnel, stop cock, and jet,	4.00
82.	Sliding Rod and Brass Plate, with fixtures,	5.00
83.	Sliding Rod and Packing Screw, with regulating binding screws and hook and pincers,	2.00
84.	Sliding Rod and Packing Screw, with ball handle and hook and pincers; (used with Electrics,)	1.75
85.	Sliding Rod; with packing screws, with ball handle, 1.00,	1.25
86.	Air Gun Barrel and Balls to use with condenser, 50 cents and	1.00
87.	Improved Vane and Mill, for use in air and in vacuum; illustrates resistance of the air,	7.00
88.	Sheet Rubber Bag, with cap and hook, 1.25; with stop cock,	2.00
	NOTE. — For large Rubber Bags, see Chemicals.	
89.	Apparatus illustrating the absurdity of suction, 36 inches high,	5.00
90.	Large Siphon Barometer, with brass cap and stop cock, for exhausting,	5.00
91.	Illustrates the pressure of air necessary to the working of a Lifting Pump. (See *Hydraulics.*)	
92.	Single Transferrer; has a brass capped two-quart bell glass, stop cock, brass plate, jet, and small bell glass; (is made up of parts before enumerated,)	5.00
93.	Condensing Chamber of heavy hammered copper, with dome and side sockets, and interior tubes; 4½ inch diameter, 250; six inch diameter,	4.00
94.	Large Copper Condensing Chamber, — globe form, with foot, — ten inches diameter, with stop cock and interior jet,	10.00
95.	Improved Glass Condensing Chamber; capacity two quarts, one inch thick; screw cap, with two inch opening, and wrench,	10.00

No. 93.



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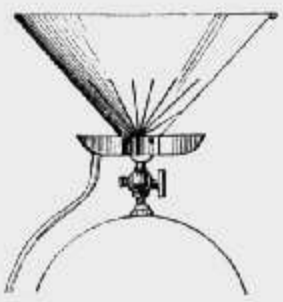

No. 100.

No. 101.

No. 102.

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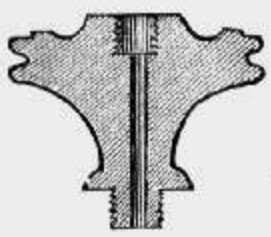

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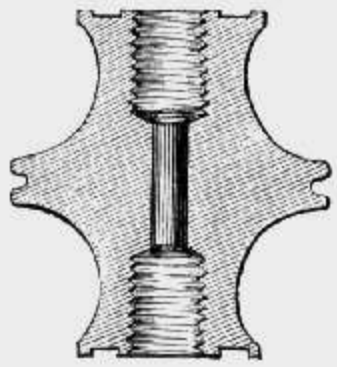

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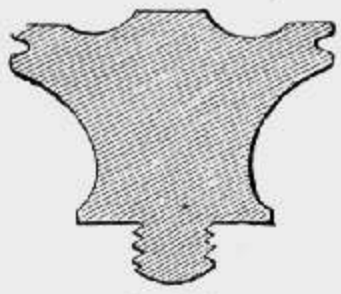
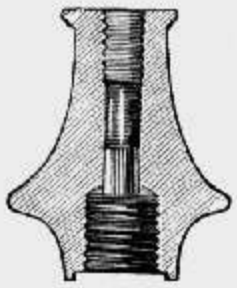


No. 110.

NUMBER		PRICE
96.	Pressure Gauge, for experiments with glass chamber, ...	1.00
97.	Square Vials, for experiment with condensed air in glass chamber, per dozen.	1.00
98.	Horizontal Connecting Piece, for glass chamber,.	.50
99.	Bell, for condensed air in glass chamber, ...	1.00
100.	Pneumatic and Hydrostatic Paradox, (for supporting a ball on a jet of water,) which includes paradox tunnel and balls, 1.50 ; water pan and tube, 75 cents ; stop cock, with interior and exterior jets, 2.00	4.25
101.	Plate Paradox, with mica disk ; the disk, though lying loose upon the plate, cannot be blown off, 1.00 and.....	1.25
102.	Pipe Paradox, with Balls, 1.00 and	1.25
103.	Condensation Gauge and Stand, siphon form, in glass case, ...	2.50
104.	Stop Cock, large screw ; 3 inch, 1.00 ; 3½ inch, 1.25 ; 4 inch, 1.50 ; 4½ inch, 2.00 ; 5 inch,.....	2.50
105.	Stop Cock, small screw, 1½ inch,.....	.75
106.	Iron Stop Cocks to use with mercury, same prices.	
107.	Connecting Screw ; large and small threads,.....	.50
108.	Double Interior Screw Coupling ; large thread,.....	.50
109.	Guard Screw ; fits pump plate, ...	.50
110.	Screw Plug for closing brass caps, &c., exterior screws,.....	.50
111.	Double Interior Coupling, large and small screw, ...	.50
112.	Gallows Connecter and Tip ; exterior screws,.....	1.25
113.	Gallows Connecter and Tip ; interior screws,.....	1.25
114.	Long Connecter for connecting Revolving Jet, &c. inside a bell glass to a stop cock in the cap or brass plate,.....	.50
115.	Pear Gauge, for determining the actual bulk of air exhausted from a bell glass, (without sliding rod,).....	3.00



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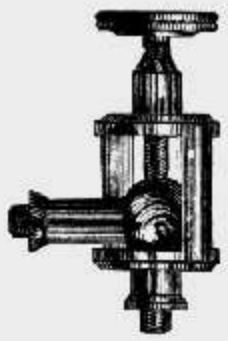

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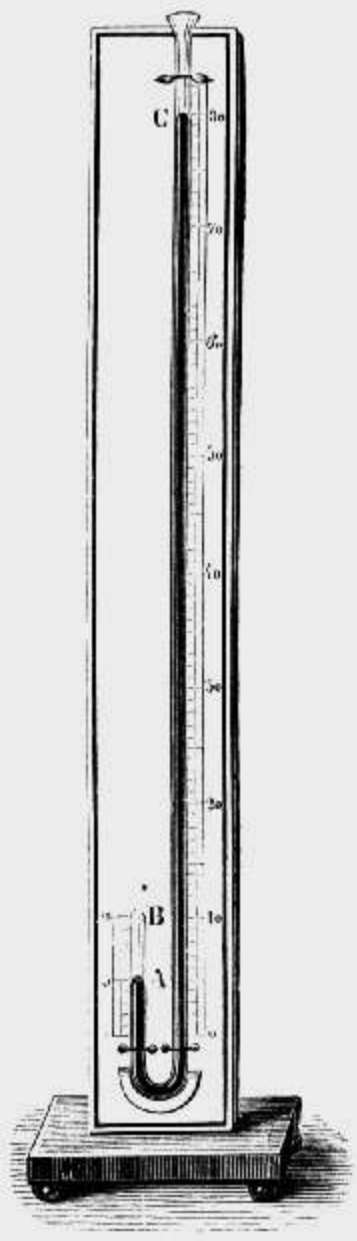

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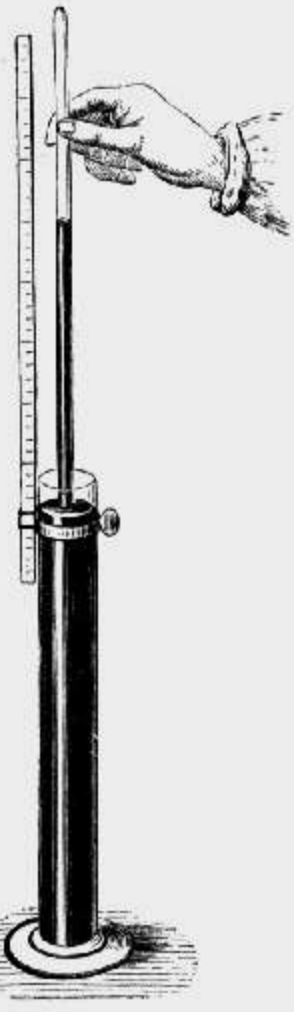
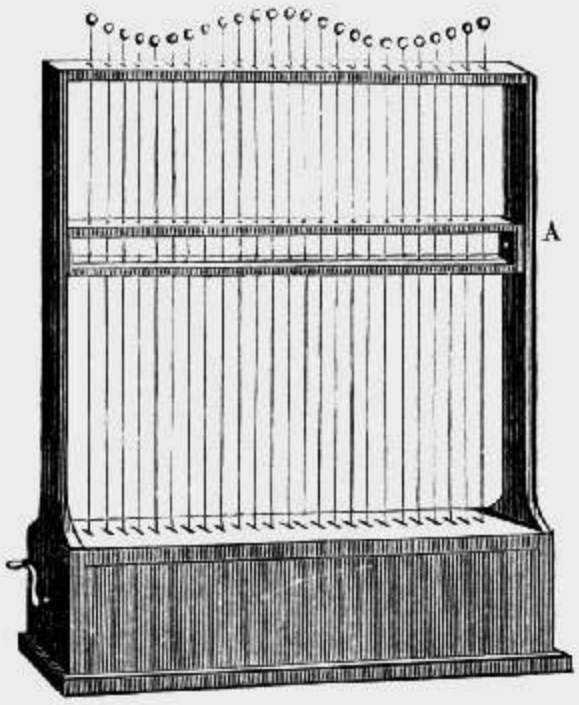


No. 118.

NUMBER.		PRICE.
116.	Mariotte's Law Apparatus; an upright support of wood, 46 inches high, neatly finished and painted, to which is attached a bent glass tube, the shorter branch with a closed end and the longer one furnished with a funnel, a graduated scale is attached to each, 15.00 and	$20.00
117.	Mariotte's Law Apparatus; support similar to No. 116; the tubes with iron sockets and screws, connected by an iron tube with a stop-cock; the shorter branch closed by an iron cap and screw-plug; an additional tube of 33 inches in length is attached by iron screw couplings, 25.00 and	30.00
118.	Mariotte's Law Apparatus, for pressure of less than one atmosphere; tall mercury cistern with closed tube and graduated scale, 5.00.....	7.00
119.	Wood Cylinders, and weight for sinking when the air is removed from the pores,.....	.25
120.	Leather Collars, for stop-cocks, assorted, per hundred, ...	.25
121.	Oil, prepared to use with Philosophical Instruments, 25 cents, and....	.75
122.	Brass Caps, for bell glasses, from one half to two inches diameter, from 15 cents to	.50

THEORY OF UNDULATIONS.



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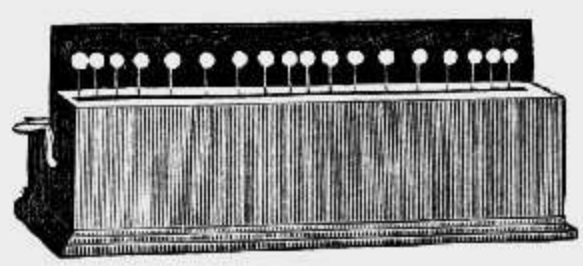
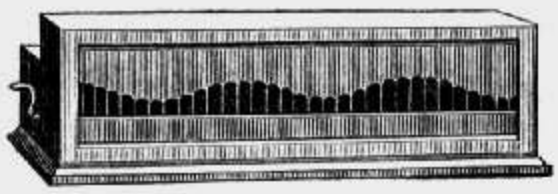


No. 3.

NUMBER.		PRICE.
1.	A Cord of elastic steel or brass wire, wound in a helix, half an inch in diameter, for illustrating progressive wave motions,	$3.50
2.	Snell's Improved Powell's Wave Instrument, for showing the Undulations of Light, in Plane, Elliptical, and Circular Polarization. The frame is of mahogany, 24 inches long by 36 inches in height; twenty-four white balls are supported upon slender steel rods, to which motion is communicated by an equal number of eccentrics placed upon a shaft within the frame, the balls are arranged in two entire waves. By raising or depressing the sliding frame (A), which is sustained by springs, the balls may be made to move either in straight lines, ellipses, or circles,	35.00
3.	Snell's Illustration of Sound Waves, or Waves of Condensation and Rarefaction. In this species of wave, the particles simply oscillate back and forth in the line of the wave. Thirty white balls are arranged to form two and a half waves, each ball oscillates 1½ inches, the motion given by guides placed upon an axis within the frame; a black screen is placed behind the balls; the frame, of mahogany, is thirty inches in length. The instrument illustrates longitudinal vibrations in a most striking and beautiful manner,	25.00



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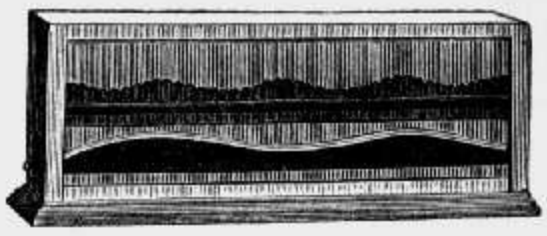


No. 5.

NUMBER. PRICE.

4. Snell's Illustration of Water Waves; thirty ebony keys, forming two and a half waves, rise and fall by eccentrics placed on a shaft within the frame, showing the form and motion of the undulations of water. As the keys perform their perpendicular oscillations in regular succession, they produce a steady onward movement of the waves, and thus the fact, of which the pupil finds it difficult to conceive, that the water itself only rises and falls, while the waves move horizontally, is made visible, and rendered intelligible, ... $20.00

5. Dr. Young's Instrument for showing Interference of Water Waves, as improved by Prof. Snell. Fifty ebony keys, arranged in a series, and kept in place by a bar in front, constitute the upper system of waves, the lower system is simply a dark board, which can be elevated by a lever at the back of the frame; when this is raised, all the ebony keys rest on its edge, so that their tops give the resulting form of both systems combined. If the lower system is similar to the upper one, the resultant is a system of double the height, or else becomes a straight line; there are four boards with different systems; the frame, of mahogany, thirty inches long, ... 17.50

6. Snell's Illustration of the Oscillation of a Particle of the Ether in Common or Unpolarized Light. The vibrations in common light are in all transverse directions, while those of polarized light are limited to one direction. A white ball, in front of a black screen, makes rapid oscillations, but constantly changes the line of its movement, — now horizontal, then slowly shifting through all oblique directions, till it is vertical, and so on. The motion is produced by a toothed wheel gearing into a concave ring, somewhat like Wheatstone's *Photometer*. By a simple adjustment, the ball may be made to describe straight lines, or ellipses, ... 12.50

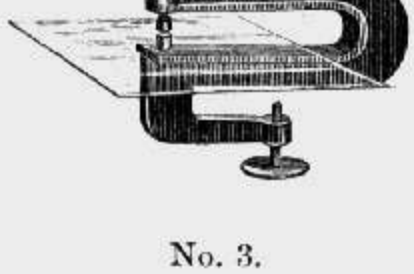
7. Apparatus for showing the Interference of Waves in an Ellipse, and that waves propagated from one of the foci converge to the other; Ellipse 8 inches in diameter, for mercury, ... 4.00

8. Apparatus for showing Propagation and Reflection of a Wave; a trough with two portions at right angles, for mercury, ... 4.50

9. Wheatstone's Kaleidophone; a silver bead upon a steel wire, secured to an iron pedestal, illustrating the superposition of small motions; the reflected light from the bead describes a variety of very beautiful curves, ... 2.00

ACOUSTICS.

No. 1.

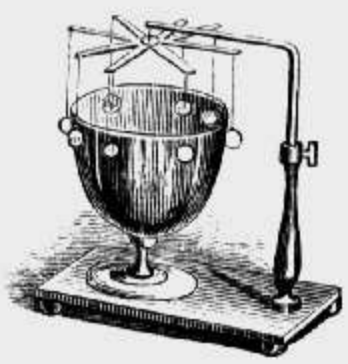


No. 3.

No. 4.

No. 8

NUMBER.		PRICE.
1.	Sonometer; for illustrating the four laws of vibrations of cords; with two graduated scales and movable bridges, series of weights to regulate the tension of the cords,	30.00
	Two wires of brass with diameter as 1 to 2; two wires of same diameter of platinum and iron, and spool of cord,	3.00
2.	Monochord; sounding-board box, graduated scale and movable bridge, tension key, and cord,	15.00
3.	Iron Screw Press; for confining a plate of glass or brass for vibrations, with table clamp screw,	5.00
4.	Basement and Pillar, with Screw and Nut, for confining a brass or glass plate,	3.50
5.	Plates of Glass, of different forms, — square, triangle, circle, parallelogram; by throwing fine sand upon the plate, and vibrating by the bow, the beautiful and symmetrical nodal figures are produced; 75c. to	2.00
6.	Brass Plate, thirteen inches diameter, for vibrating, and for the experiment of the rotation of Lycopodium,	3.00
7.	Brass Plate, thirteen inches square, for vibration,	3.00
8.	Hopkins's Apparatus, for Interference of Waves of Sound; a compound tube with branches of equal length, base, and pillar,	6.00
9.	Hopkins's Apparatus; arranged to be used over the glass plate in the iron press; sliding adjustable tube of japanned metal, basement and pillar,	6.50
10.	Violoncello Bow, for vibrating plates,	2.00



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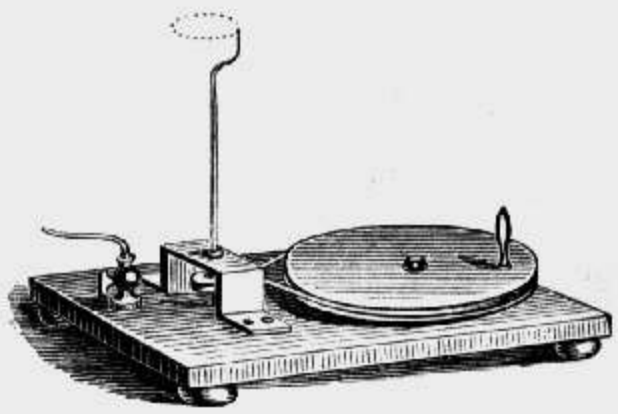

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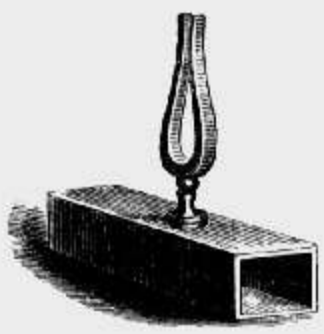
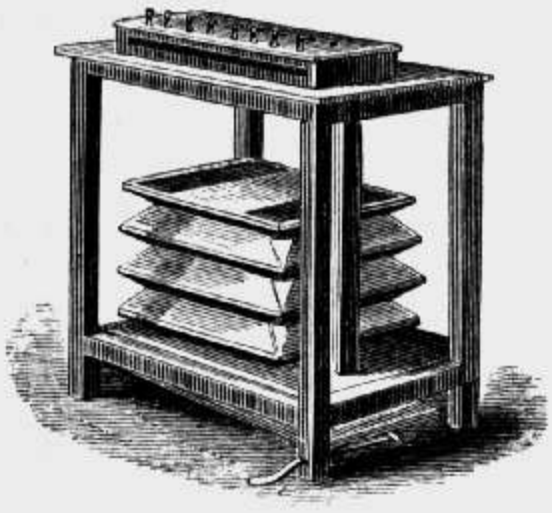


No. 13.

No. 15.

NUMBER.		PRICE.
11.	Apparatus for showing the Nodes of a Bell; a large glass bell, around the rim of which is suspended a row of cork balls; mahogany basement; the vibration is produced by a violin bow,	7.50
12.	Prof. W. B. Rogers's Apparatus, to show the Intermittence of Sonorous Flames; a vertical gas jet, bent so that its point will describe a small circle within a glass tube; mahogany base and pulleys, with stop-cock and tubes,	7.50
13.	Diapason, or Tuning Fork; mounted upon a closed tube; the vibration is produced by drawing a steel pin between the branches, or by a violin bow, the fork is tuned to $ut_3 = 512$ simple vibrations per second; the tube of cedar is tuned to the same note,	6.50
14.	Diapasons; set of three Forks mounted upon the same tube, tuned to a perfect third and fifth,	15.00
15.	Frame with Membrane, for showing the vibrations produced in the air by a bell; shown by sand sprinkled upon its surface,	2.50
16.	Savart's Experiment of Sonorous Vibrations of a Jet of Water; a glass tube four feet long, fitted for suspension, with brass perforated cap; as the water flows from the tube different harmonics are produced, gradually swelling and dying away; the tones produced are exquisitely pure and delicate, 8.00; with variable jets,	10.00
17.	Tube to attach to Hydrogen Gas Generator, for musical tones,	.50
18.	Trevyllian's Experiment; a brass bar which, when heated, produces a musical tone by oscillating upon a block of lead,	3.50
19.	Tuning Fork and Glass Flask, for showing the Polarization of Sound,	2.50
20.	Apparatus for showing the Interference of Sonorous Vibrations; two cylindrical glass jars, to be used with the Diapason or Tuning Fork. Hold the fork over one of the jars, a *tone* will be produced; approach the other tube horizontally, and the tone will cease; withdraw either tube, and the tone reappears. These curious phenomena arise from the interference of the sonorous vibrations excited in the air contained in the glass vessels,	3.00

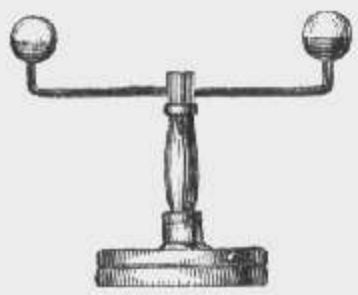


No. 21.

No. 34.

NUMBER.		PRICE.
21.	Organ Bellows, with Wind Chest and Keys; for experiments with pipes, &c.; neatly mounted in frame, 35.00 and	$45.00
22.	Siren; an apparatus for determining the number of vibrations per second of any note of music, with dials and hands,	25.00
23.	Siren; without dials and hands,	15.00
24.	Organ Pipes, of cedar, open; 12 and 24 inches long, 1.25 and	2.50
25.	Organ Pipes, of cedar, closed; 12 and 24 inches long, 1.50 and	2.75
26.	Organ Pipes, of metal; 12 and 24 inches long, 1.75 and	3.00
27.	Eight Pipes, of cedar, composing one octave,	15.00
28.	Set of three Pipes, of cedar, of different diameters, but voiced in unison; the three sonorous waves are of same length,	5.00
29.	Set of three Pipes; of same length, but of different diameters,	5.00
30.	Pipe of 24 inch length, made in two parts at right angles,	3.00
31.	Pipe, with movable Piston,	3.00
32.	Pipe; furnished with a slider, which closes the tube at the node of vibration, showing the sound to be unchanged,	3.50
33.	Reed Pipe; model of the trumpet stop in the organ with glass chamber,	3.50
34.	Savart's Apparatus, for the vibration by influence of a column of air; a bell upon a pedestal for vibrating by a bow; tube mounted on pedestal with movable piston, 25.00 and	35.00

HEAT.



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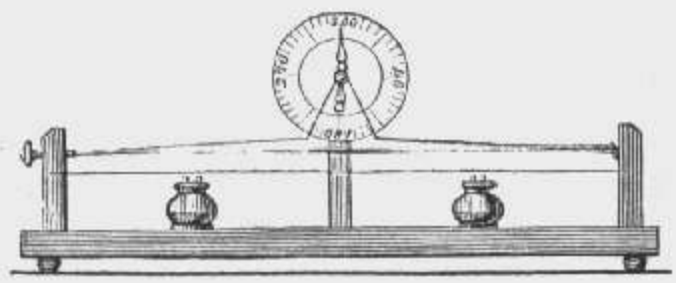

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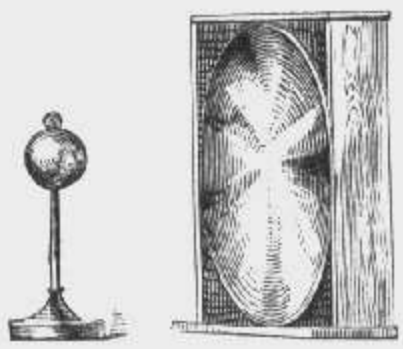

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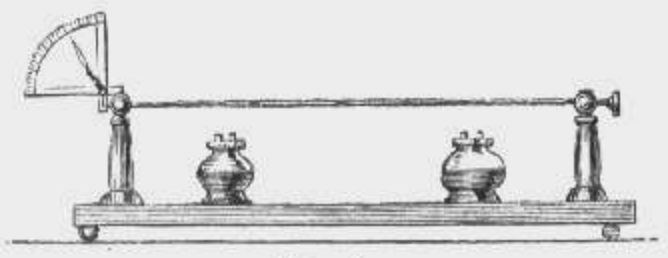

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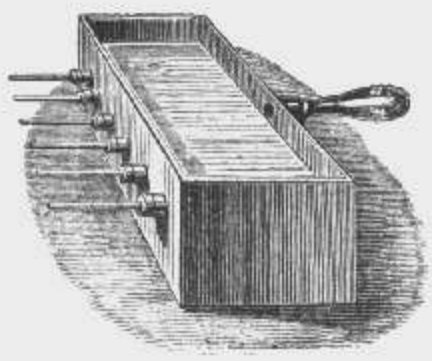

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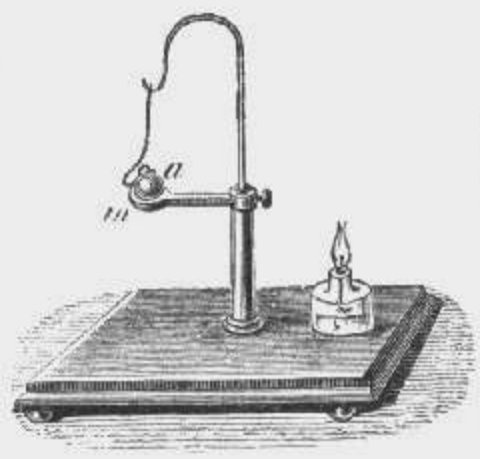

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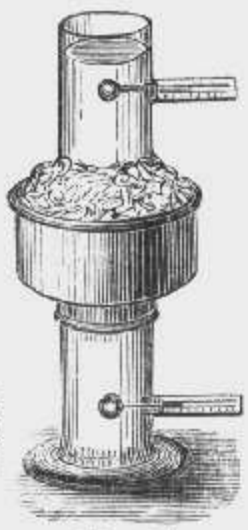
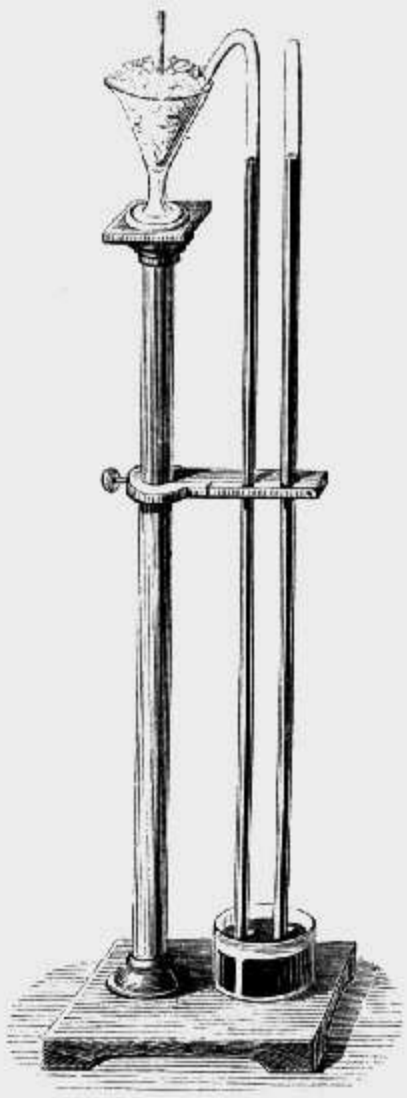


No. 14.

NUMBER.		PRICE.
1.	Air Thermometer; glass bulb and tube, 25 and	$ .50
2.	Leslie's Differential Thermometer,	3.00
3.	Franklin's Pulse Glass, or Spirit Boiler,	.75
4.	Spirit Boiler; mounted on a mahogany frame, to use with reflectors,	2.00
5.	Reflectors of Brass, thirteen inches diameter, of true parabolic form; highly polished; adjustable stands, with ball and phosphorus holder,	35.00
6.	Reflectors; pair of heavy Planished Reflectors; thirteen inches diameter, in cases, with iron ball and stand,	6.00
7.	Pyrometer, with brass and iron Rods; mahogany frame, with dial, needle, and two spirit lamps,	3.50
8.	Pyrometer, for showing the Expansion of a Rod by Heat; brass and iron rods with quadrant and needle and two spirit lamps,	4.00

No. 16.



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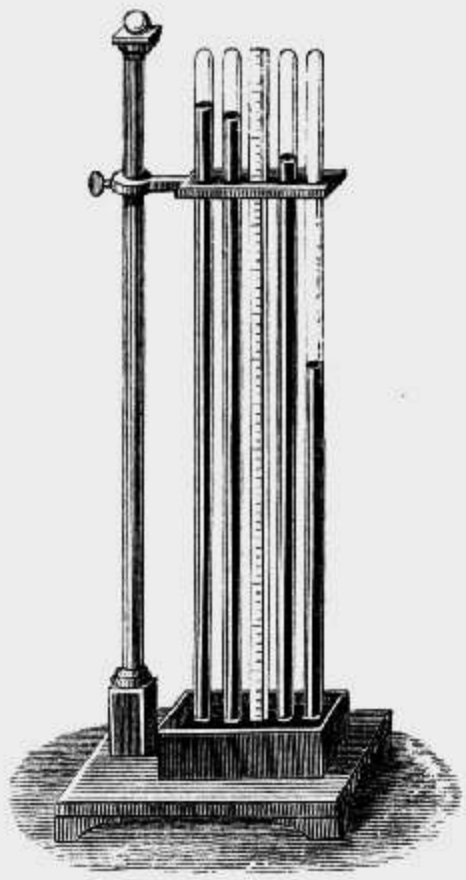
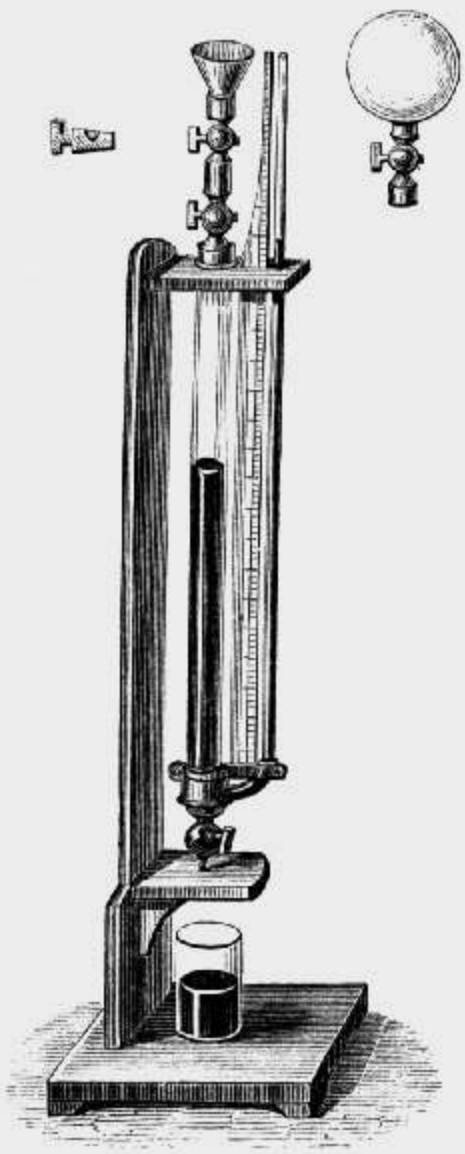


No. 18.

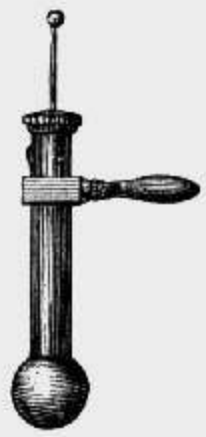
NUMBER.		PRICE.
9.	Conductometer; brass ring and plate with tripod stand, to be used over a spirit lamp; with iron, brass, copper, tin, lead, and glass rods, 1.50 and	$2.00
10.	Conductometer of Ingenhousz; of copper, with metal cylinders and handle,	5.50
11.	Ring and Ball to illustrate Cubical Expansion; mounted on mahogany frame; to use with spirit lamp,	3.50
12	Ring and Ball, with handles, 1.50 and	2.00
13.	Compound Bar; of brass and iron; to show the unequal expansion of metals, 75 cents and	1.25
14.	Apparatus for the Maximum Density of Water; glass jar, with copper reservoir for freezing mixture; with two thermometers,	6.50
15.	Leslie's Radiating Cubes, a pair; the sides are painted in different colors, with shields; one has a tube for air thermometer,	2.00
16.	Tall Mercury Cistern; on iron frame with graduated glass tube, for illustr ting the tension of gases, 10.00 and	15.00
17.	Gay Lussac's Apparatus; to show the tension of water below the freezing point; mahogany frame, mercury cistern, bent and straight tubes, and vase,	8.50
18.	Apparatus to Illustrate the Instantaneous Evaporation of Volatile Liquids in a Vacuum; mahogany frame, cistern of iron for mercury, four glass tubes, and graduated scale, 12.00 and	16.00
19.	Apparatus to Illustrate the Non-conduction of Heat by Water; glass funnel with air thermometer, 1.50; with stand,	3.00



No. 23.

No. 20.

No. 22.



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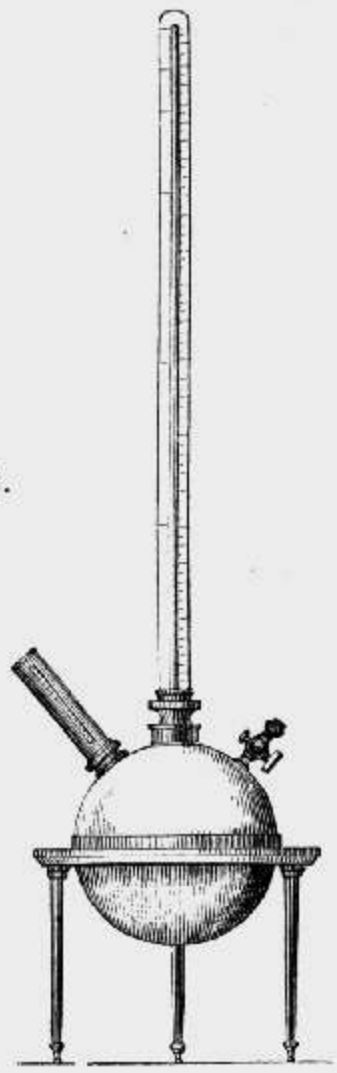
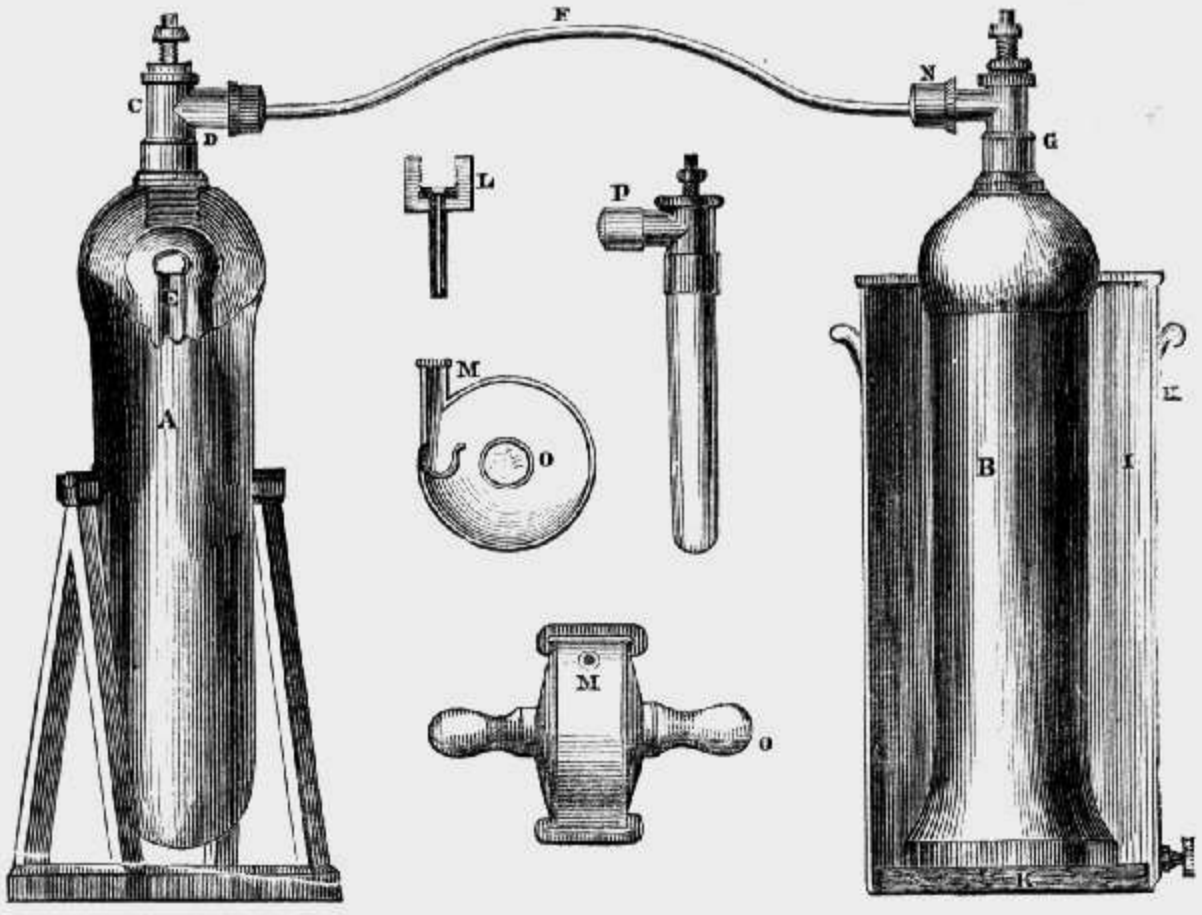


No. 25.

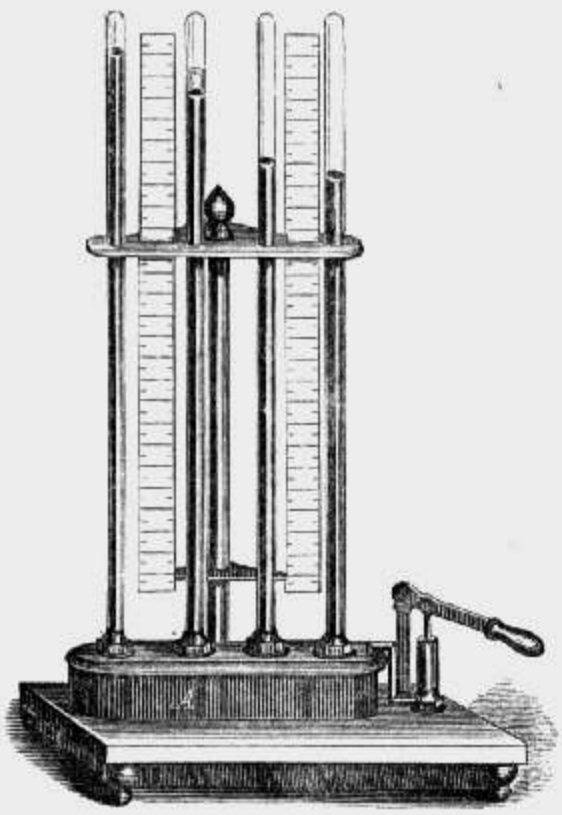
NUMBER.		PRICE.
20.	Fire Syringe; brass cylinder with box of tinder,	$1.50
21.	Fire Syringe; strong glass barrel, brass caps and piston, 3.00 and	5.00
22.	Steam Ball and Jet, or Eolipile, of brass,	1.50
23.	Gay Lussac's Apparatus, to Illustrate the *Laws of Dalton;* mahogany frame with glass tubes, funnel, and globe, with iron mountings and stop-cocks,	30.00
24.	Wollaston's Illustration of Low Pressure Steam Engine; copper globe boiler, brass cylinder, piston and rod, handle and safety valve,	3.00
25.	Marcet's Steam Globe, improved form; 5½ inches diameter; upper hemisphere of brass, the lower of iron, for holding mercury; a thermometer in brass case, stop-cock and safety valve, manometer tube and graduated scale,	35.00
26.	Steam Balls, or Candle Bombs; for exploding by candle, dozen,	.50
27.	Ritchie's Improved Model of the Low Pressure Steam Engine, with Boiler and Furnace; the apparatus is entirely of metal, handsomely painted, and is a true sectional model, showing, on the one side, the outward appearance of every part, and on the reverse, the interior, with moving pistons and valves; the air-pump, condenser, force and lifting pumps exhibiting their proper motion; the boiler also in sections, showing the flues, safety valve, steam-pipe, throttle valve, &c.; the whole instrument is carefully made, and very perfect,	35.00
28.	Steam Whistle, Model of Locomotive Whistle,	3.00



NUMBER PRICE.

29. Thilorier's Apparatus for Liquefying and Solidifying Carbonic Acid Gas; the generator (A) is made of iron and is supported by centre trunnions upon an iron frame, so that in use it can be readily inverted; into the top is screwed a heavy brass cap, which is furnished with steel vent screw, and screw for attaching a connecting tube; within the generator is placed a copper tube to receive the sulphuric acid; the receiver is of similar form, except that it has a broad base, with cap and its connecting screws; a long copper tube with connections; wrench for the brass caps, connecting screws and vent-screws, mallet, cylindrical brush, &c.; a connector (L) is fitted to screw to the receiver, to which is attached the brass box (M), fitted to receive the solid carbonic acid; also a strong glass tube (P), with cap and vent-screw, to exhibit it in the liquid form. In the construction of this instrument every care will be used to render it perfectly safe; the iron used is that prepared by the United States Ordnance Department for guns, and in future every generator and receiver will be *tested* and *proved* by hydraulic pressure to more than double the required strength, and shall have sustained a pressure of over eighty atmospheres, or 1200 lbs. to the square inch, ... $150.00

30. Ritchie's Improved Bianci's Apparatus for Liquefying Gases; this beautiful instrument is designed to compress gases by means of a force pump; the receiver is of iron encased in brass, and capable of resisting a pressure of 500 atmospheres; the pump is of steel, with steel piston, and is connected to the driving-crank by an inverted working-beam, by this means the receiver is brought to a convenient height; the receiver is surrounded by a copper vessel for ice and salt, and the pump is also enclosed in a cylinder, through which ice-water flows; the frame is of iron; the driving shaft has balance wheels and cranks; every part of this instrument is most carefully constructed, ... 300.00



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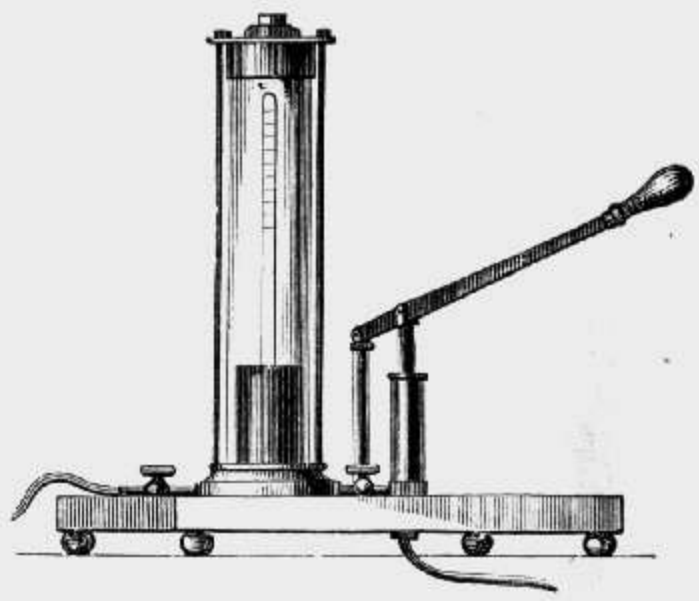


No. 32.

NUMBER. PRICE.

31. Prof. Cooke's Apparatus for showing the Identity of Gases and Vapors; this beautiful instrument consists of a strong iron cistern for mercury, into which is screwed four glass tubes, — three to contain gases which liquefy at different pressures, the fourth, air for a manometer; force pump with stop-cocks and tubes; basement with frame and graduated scales; the manometer graduated to atmospheres; each tube is fitted with a valve that it may be readily filled over a mercury trough, and put in place, ... $35.00

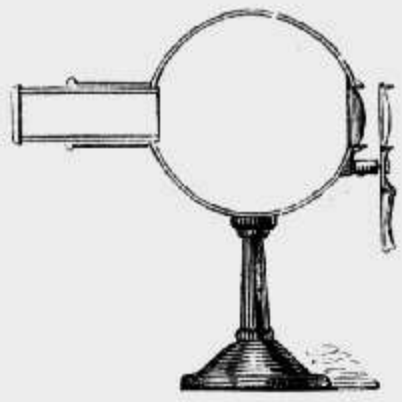
The phenomena of the liquefying of gases are strikingly exhibited by this instrument; the pressure exerted by the pump causes the mercury to rise gradually and equally in each tube, until one of the gases begins to liquefy; it then remains constant, (as shown by the manometer and other tubes,) until all the gas has disappeared, the mercury then rises in the three remaining tubes, until a second gas commences to liquefy, and so on. — See *Cooke's Elements of Chemistry*, page 582.

32. Apparatus for Liquefying Gas by Hydraulic Pressure; a strong glass cylinder capable of bearing a pressure of twelve atmospheres, with brass basement and cap, secured by iron rods; an opening in the cap admits an iron cistern for mercury, in which is inverted a tube filled with the gas for liquefying; a pump by which water is forced into the cylinder, forcing the mercury up into the tube, compressing and liquefying the gas; mahogany basement; pan for water, valve, stop-cock, hose, and jet, 35.00 and 40.00

33. Apparatus for Specific Heat; basement and frame supporting five balls of copper, iron, tin, zinc, and lead, of ½ lb. weight, each in a glass tumbler; in use, immerse all in boiling water, then plunge each ball in its tumbler, with equal quantities of water in the tumblers; the water will be found to be raised to unequal temperatures, ... 6.00

OPTICS.

No. 2.



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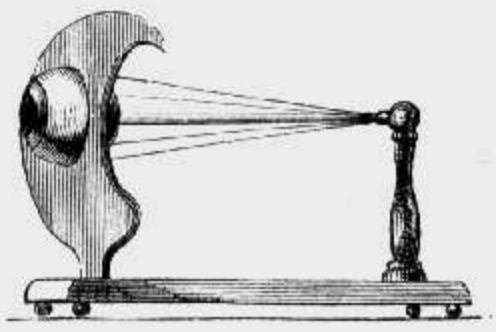

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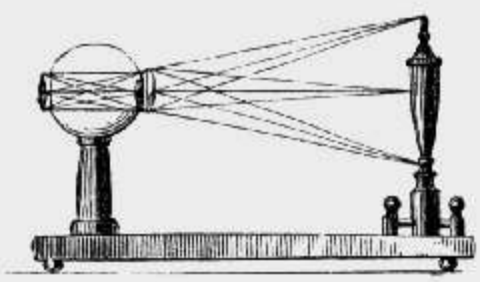
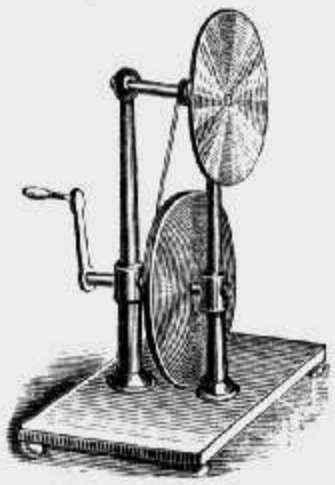


No. 12.

NUMBER.		PRICE.
1.	Prism; of flint glass, well polished; three inches, 50 cents; four inches, 75 cents; six inches, 1.25; eight inches,	$2.00
2.	Mounted Prisms; six inches, 3.00; eight inches,	4.00
3.	Prism; of optical glass in sections of flint, and crown glass, 4.00 and	6.00
4.	Prisms; of crown and flint glass mounted, to show the theory of achromatism,	9.00
5.	Conical Prism; to produce circular spectrum; mounted in brass,	7.00
6.	Multiplying Glass, in tube,	.50
7.	Set of six Neutralizing Lenses; for illustration, viz., double convex and concave; plano convex and concave; meniscus convex and concave; 2½ inch diameter, very fine,	8.00
8.	Set of six Neutralizing Lenses; two inch,	6.00
9.	Set of four Neutralizing Lenses; viz., double and plano convex and concave; 2½ inch diameter,	5.50
10.	Set of four Neutralizing Lenses,; two inch,	4.00
11.	Artificial Eye; brass globe of four inches diameter, with lens; concentric draw tubes with ground glass for the retina; a convex and concave lens are mounted on a frame and revolve in front of the cornea. This instrument illustrates the application of spectacles for long and short sight,	9.00
12.	Models of Human Eye; in three parts, viz., the eyeball dissected, and stand; the muscles of the eye; the cause of the long, short, and perfect sight,	12.00



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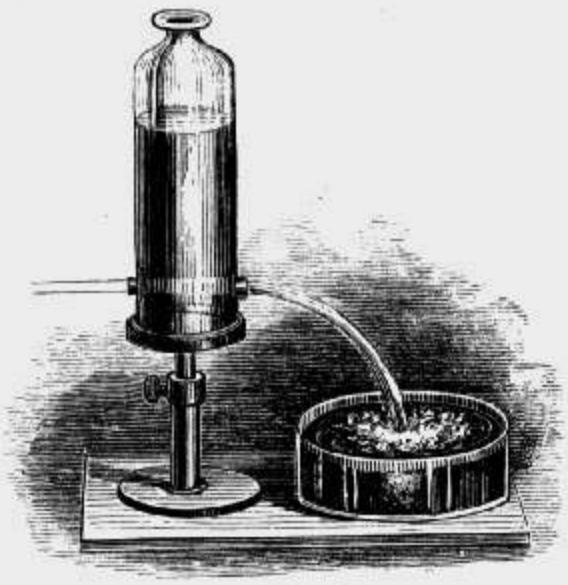
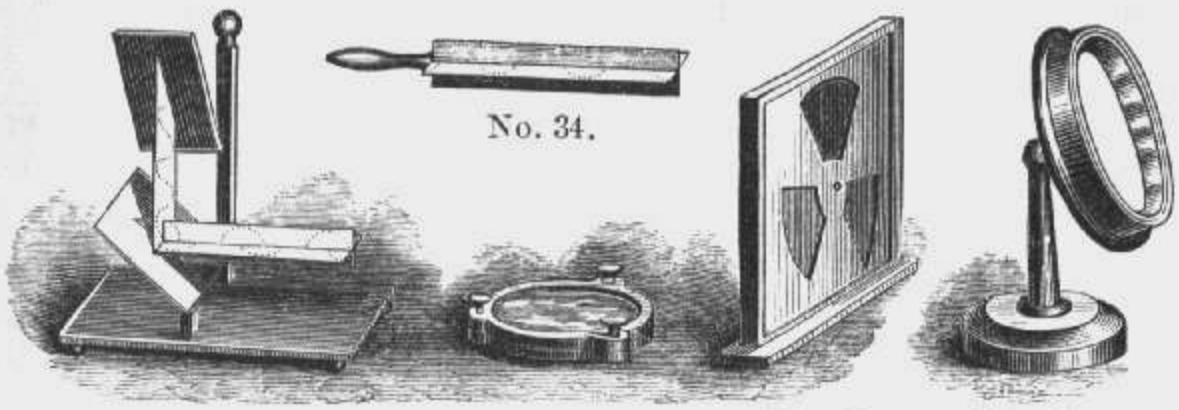


No. 23.

NUMBER.		PRICE.
13.	German Mirrors; convex, concave, and cylindrical; four inch,	$1.25
14.	German Mirrors; convex, concave, and cylindrical, six inch,	2.00
15.	Multiplying Mirrors; four inch, 1.50; six inch,	2.00
16.	Mirror of Black Glass, or Claude Lorraine Glass; convex, in case,	6.00
17.	Set of Seven Mirrors; mounted to reunite the seven prismatic colors and recompose white light, 10.00 and	15.00
18.	Kaleidoscope; neatly mounted, ten inch,	.75
19.	Kaleidoscope, with Object Glass; the light is reflected from natural objects,	1.50
20.	Revolving Disc; frame of mahogany, with pulleys and crank; a shaft with screws for confining discs of metal and cardboard,	6.00
21.	Disc; with the prismatic colors for recomposing white light by reflection,	1.50
22.	Set of twelve Discs; of cardboard, of different colors;—they are cut in such manner that they may be arranged in any way, and any combination in the circle, with forms to produce the graded or the imperceptible blending of one color into another, producing very curious and remarkable effects; in box,	3.50
23.	Apparatus for showing the Total Reflection of Light in a Liquid Vein; a glass jar with tube and cap, opposite to which is placed a disc of plane glass, a ray of light from the shutter in a darkened room is transmitted through the water, and into the vein as it issues from the jar, and by total reflection follows the curvature of the jet to the vessel into which it falls, from the surface and waves of which it is reflected; *the light is apparently poured out of the jar and bubbles up in the waves below* (See No. 28, *Hydraulics*),	5.00
24.	Stereoscope; Wheatstone's reflecting stereoscope, illustrating the effects of binocular vision,	8.00
25.	Stereoscope; Brewster's refracting stereoscope, mounted in mahogany or morocco leather, 3.00 to	4.00
26.	Stereoscope; mounted upon a stand, 5.00 to	7.00
27.	Photographic Pictures; landscapes, buildings, statues, &c., 30c. to	.50
28.	Photographic Pictures; colored, 40c. to	.75
29.	Photographic Transparencies; 75c. to	1.50
30.	Geometrical Diagrams; box of plates,	1.00



No. 34.

No. 35. No. 49. No. 53. No. 54.

NUMBER.		PRICE.
34.	Model of a Ray of ordinary Light, showing two Planes of Vibration,	$2.50
35.	Model illustrating the Action of Reflectors in Polarizing Light,	10.00
36.	Model illustrating the Properties of two Tourmaline Plates in Polarizing Light,	7.50
37.	Large Hollow Glass Model of a Crystal of Iceland Spar, with planes to illustrate the separation of the ray by double refraction,	6.50
38.	Tourmaline Polariscope; mounted in pincers, for interposing a crystal, 5.00 to	12.00
39.	Nicol's Prism; for polarizer or analyzer, 5.00 to	12.00
40.	Double Image Prism; of Iceland spar, 3.00 and	4.00
41.	Norremberg's Reflecting Polariscope,	25.00
42.	Mirror of Black Glass; for polarizer, 1.50; in frame,	2.50
43.	Selenite Objects; mounted in sliders; the films of selenite represent geometrical figures, flowers, fruits, &c.; seen by ordinary light they are transparent, but in polarized light the figures are seen in brilliant complementary colors, 1.50 to	4.00
44.	Plates of Crystals, cut perpendicularly and obliquely to their axes; Iceland spar, arragonite, beryl, &c., 2.00 to	5.00
45.	Unannealed Glass of six forms, each,	1.50
46.	Press for showing the Rings in Glass Plates,	2.50
47.	Plates for Newton's Rings; pair of glass plates,	1.00
48.	Screw Clamp Press, for do.,	1.50
49.	Plates for Newton's Rings; mounted in brass frame with screws; the plates are four inches diameter, and are ground and polished with great care,	6.00
50.	Camera Obscura; mahogany box, well finished,	6.00
51.	Camera Lucida; mounted, 7.00 and	12.00
52.	Camera Lucida Prism,	5.00
53.	Prof. Snell's Instrument for exhibiting the Accidental Colors in Vision; a white screen, with three openings, each of 60°, behind which revolves a disc with the colors of red, blue, and yellow, alternating with white; in use, fix the eyes intently upon a bead in the centre for a length of time, then let the disc be turned, so as to present a perfectly white surface, the *complementary* colors of each of the departments will be vividly *seen*,	5.50
54.	Prof. Snell's Instrument for showing Caustics by Reflection, in Successive Orders; a ring of steel highly polished, mounted in brass, with movable joint, pillar and basement, so as to place in sunbeam; the caustics will be shown upon the white plane with great beauty,	7.50

I have lately visited London and Paris, and have made arrangements to obtain from the first makers Microscopes, Telescopes, Transit Instruments, &c., and also for superior Objectives and Eye-Pieces for Telescopes of large size, which I mount to order, Equatorially or otherwise.

The instruments described below are of superior excellence. I shall not in future keep on hand any of the low-priced instruments, their performance being rarely satisfactory.

TELESCOPES.

NUMBER. PRICE

55. Telescope; four feet, mounted in brass, on brass tripod; rack work for vertical adjustment; object-glass three inches in diameter; two terrestrial and two celestial eye-pieces; sun shades; finely finished, with mahogany box, ... $150.00

56. Telescope; three feet, mounted on brass with tripod; object-glass, 2½ inches; one terrestrial and two celestial eye-pieces; sun shade; with box, ... 100.00

57. Telescope; 2½ feet, of similar mounting; object-glass 2 3-10 inches; one terrestrial and two celestial eye-pieces and shades; finely finished, with mahogany box, ... 75.00

Telescopes of greater or less size at proportionate prices.

58. Brass, Wood, and Leather Mounted Spy Glasses; at prices from 9.00 to 22.00

59. Marine Opera Glasses, for Tourists; with large achromatic objectives; very fine, mounted neatly and substantially, 12.00 and 15.00

MICROSCOPES.

60. Smith, Beck & Beck's Educational Microscope; this superior instrument has object glasses of 1 inch and ¼ inch, of apertures respectively of 22 and 75 degrees, and two eye-pieces; a fine stand with a joint for varying the position, quick and slow motions to the body; a stage with springs that allow any motion to be given to the object, a supplementary stage, concave mirror with new and complete adjustments, side condensing lens, diaphragm with a shutter, forceps, glass plate, and pliers; mounted in mahogany cases, ... 85.00

61. Additional Apparatus for the above Instrument. — Lieberkuhn and dark well; Wenham's parabolic reflector, for dark field illumination; flat mirror polarizing apparatus, with prisms and selenite; camera lucida; glass micrometer; small live box; glass trough with wedge and spring, ... 40.00

2. Two Inch Object Glass, ... 12.00

This Instrument has received the most unqualified approbation of the microscopists of Europe and America.

63. Oberhauser's Achromatic Compound Microscope; brass frame and stand; two systems of objectives, and two eye-pieces with powers from 65 to 300 diameters; slide and screw adjustments; diaphragm, condenser, forceps, &c.; in mahogany box, ... 40.00

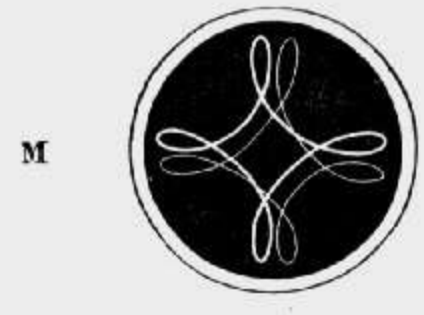
64. Oberhauser's Student's Microscope; brass frame and stand; system of objectives, powers of 175 and 300 diameters; slide and screw adjustments, condenser, diaphragm, forceps, &c., ... 27.00

65. Compound Microscope; with three objectives, used separately or combined, in neat mahogany boxes, three sizes, 4.00, 5.00 and 7.00

66. Botanical Microscope; in case, 1.25 and 2.50

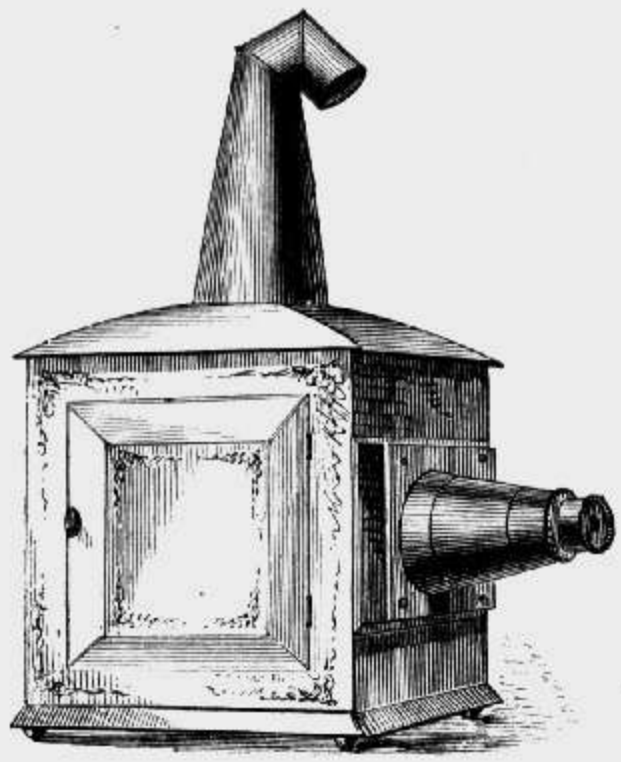
67. Microscopic Objects; very superior quality, each 37 cents; in mahogany boxes of twelve, 4.00; twenty-four, ... 6.00

No. 91.



No. 91 A.

NUMBER.		PRICE.
78.	Transparent Objects for the Microscope; neatly prepared in glass sliders with Canada balsam; 12 objects in box, 2.50 and	$4.00
79.	Microscopic Photographs; The Lord's Prayer, Declaration of Independence, portraits, landscapes, &c., each,	1.00
80.	Microscopic Objects; for polarizing, 50 cents and	.75
81.	Micrometer; with lines finely divided upon glass, 1.25 and	2.00
82.	Writing Diamonds, or Pencil Diamonds,	3.00
83.	Microscopic Objects; tests, objects for the polariscope, diatomacea of a great variety from all parts of the world, spicules of Gorgoniæ, and a general assortment of favorite objects, prepared with great care, arranged in box containing from thirty to one hundred objects.	
84.	Hand Magnifier; a fine plano-convex lens, 2½ inches diameter, neatly mounted with handle, 1.75 and	2.25
85.	Hand Magnifier; 4 inches diameter, with handle,	3.75
86.	Double Lens Magnifier; two plano-convex lenses in a metal frame, 75 cents to	2.25
87.	Magnifying Lenses; in horn mounting, 37 cents to	1.00
88.	Magnifying Glasses; with one, two, or three lenses, mounted in horn and tortoise shell, 50 cents to	2.50
89.	Coddington Lenses; silver mounting, 1.75 and	3.50
90.	Convex Lens with Diagonal Mirror; mounted on stand for viewing prints, 2.00 and	3.00
91.	Wheatstone's Photometer; a brass cylindrical case enclosing a system of wheels giving motion to a disc upon which is placed one or more polished beads. The instrument is founded on the principle of the endurance of the impression of light on the retina; with a single bead as used for photometer, a double system of curves is produced, (fig. 91 A,) measuring the intensity of two lights with great accuracy; there are also four discs with beads, which can be arranged in different forms, which produce in solar light an endless variety of most beautiful elliptical curves, 5.50 and	7.50
92.	Wheatstone's Pseudoscope; this instrument apparently reverses the condition of things; convex objects appear concave, a rilievo becomes an intaglio, a sphere a hollow sphere, &c.,	8.00
93.	Polemoscope; a tube bent twice at right angles, with mirrors enclosed; an opaque object can be placed in the apparent line of vision,	4.00
94.	Polyorama Panoptique; with six views, 3.00, 5.00, and	8.50
95.	Photographs of the Moon; from the original negatives by De La Rue, F. R. S., taken by a powerful telescope; the most beautiful and remarkable stereoscopic transparencies.	



No. 96.

NUMBER. PRICE.

96. Magic Lantern; of improved construction; the condensers are of finest quality of French lenses, four inches in diameter, mounted in brass cell, the magnifiers are a combination of meniscus and plano lenses, a late improvement, by which the spherical aberration is corrected, and all parts of the picture are brought into focus and distinctly thrown upon the screen; these are mounted in a brass draw tube with a diaphragm; an improved solar lamp with silver-plated reflector; the lantern is handsomely japanned, ... $25.00

97. Magic Lantern; similar to No. 96, with six-inch condensers, for the use of paintings 4 to 5½ inches in diameter, (for usual size paintings this Lantern has no advantages over No. 96,) 40.00

98. Oxy-Hydrogen Calcium Light Attachment, with Ritchie's Improved Concentric Jet; with stop-cocks, gallows screws, and 16 feet of hose, 14.00

99. Microscope Attachment; mounted in brass, with a tube which is put in the place of the magnifiers of the lantern. The value of this instrument depends upon the quality of the achromatic objectives; these should be of large diameter and angular aperture. Objects of less than one tenth of an inch in length cannot be satisfactorily thrown on the screen; price without Objectives, ... 20.00

Achromatic Objectives, made by Smith, Beck & Beck; these are the finest and most valuable powers, of large diameter and angle of aperture; they can be attached and used with any good microscope.

100. Objective, 1 inch focal length, angle of aperture 22°, ... 21.00
101. Objective, ⅔ inch focal length, angle of aperture 30°, ... 27.50
102. Objective, ¼ inch focal length, angle of aperture 75°, ... 20.00
103. Achromatic Triplet Objectives; of French make, ¼ inch focal length, but of small angular aperture, ... 8.00
104. Dissolving Views Apparatus; with two lanterns, oxy-hydrogen light, with thirty feet of hose; large copper hydrogen generator and purifier, (Nos. 61 & 62, *Chemistry*;) large rubber bag for oxygen, with improved dissolving apparatus; with generators complete, ... 125.00
105. Dissolving Views Apparatus; two lanterns with solar lamps, mounted on basement, with dissolving apparatus, ... 60.00

SLIDERS FOR LANTERNS.

NATURAL HISTORY.

In Fifty-Six Sliders, including the following Sets, the whole in a Box.

		PRICE
Class 1.	Mammalia; 24 sliders, 100 pictures,	45.00
Class 2.	Birds; in 7 sliders, 28 pictures,	14.00
Class 3.	Amphibia; in 4 sliders, 16 pictures,	8.00
Class 4.	Fishes; in 5 sliders, 20 pictures,	10.00
Class 5.	Insects; in 8 sliders, 37 pictures,	16.00
Class 6.	Worms and Shells; in 8 sliders, 36 pictures,	16.00
	Set complete,	100.00

Each class, or set sold separately, but sets are never broken.

BOTANICAL ILLUSTRATIONS.

In Fourteen Sliders, with Compendium.

Fifty Diagrams, ... 30.00

SELECT SCRIPTURE SUBJECTS.

In Twelve Sliders.

Thirty-eight Diagrams, ... 30.00

KINGS AND QUEENS OF ENGLAND.

FROM WILLIAM THE CONQUEROR TO VICTORIA.

In Nine Sliders.

Thirty-four Diagrams, ... 15.00

VIEWS OF PUBLIC BUILDINGS, &c.

In Four Sliders.

SLIDER I.

View of Saint Paul's Cathedral, London. — The Pavilion, at Brighton. — Southwark Bridge, London.

SLIDER II.

View of Westminster Abbey. — View of the Cataract at Niagara. — Waterloo Bridge, London.

SLIDER III.

Saint Peter's Church, at Rome. — Fingal's Cave. — The Pantheon, at Paris.

SLIDER IV.

View of Mount St. Michael, Cornwall. — The Military Hospital, Paris. — View of the Island of Staffa, ... 9.60

ASTRONOMICAL DIAGRAMS.

In Eleven Sliders, packed in a Box, with a Description.

SLIDER I.

No.
1. System of Ptolemy.
2. ———— Copernicus.
3. System of Tycho Brahe.
4. ———— Newton.

SLIDER II.

5. Telescopic View of the Moon.
6. Ditto of Jupiter.
7. Telescopic View of Saturn.

SLIDER III.

8. Comparative Sizes of the Planets.
9. Comparative Distances of the Planets.
10. Orbit of a Comet.
11. The Comet of 1811.

SLIDER IV.

12. Signs of the Zodiac.
13. Inclination of the Planets' Orbits.
14. Direct and Retrograde Motion

SLIDER V. (*Lever, movable.*)

15. Rotundity of the Earth

SLIDER VI.

16. The Seasons.
17. Phases of the Moon.
18. The Earth's Shadow.

SLIDER VII.

19. Cause of the Sun's Eclipse.
20. Ditto Moon's ditto.
21. Inclination of the Moon's Orbit.

SLIDER VIII. (*movable.*)

22. Eclipse of the Sun, with a Transit of Venus.

SLIDER IX. (*movable.*)

23. Eclipse of the Moon.

SLIDER X.

24. Spring Tide at New Moon.
25. Ditto Full Moon.
26. Neap Tide.

SLIDER XI.

27. The Constellation Orion.
28. ———————— Ursa Major.
29. Various Nebulæ.
30. A Portion of the Milky Way,. 18.00

CONSTELLATIONS

In Six Sliders. Their situation with regard to the North Pole is denoted by an Arrow.

SLIDER I.

Aries. — Taurus. — Gemini. — Cancer.

SLIDER II.

Leo. — Virgo. — Libra. — Scorpio.

SLIDER III.

Sagittarius. — Capricornus. — Aquarius. — Pisces.

SLIDER IV.

Draco and Ursa Minor. — Cepheus and Cassiopea. — Andromeda and Triangula — Auriga.

SLIDER V.

Perseus and Caput Medusæ. — Boötes and Canes Venetici. — Hercules and Cerberus. — Cygnus and Lyra.

SLIDER VI.

Antinöus and Aquilla. — Ophiucus and Serpens. — Canis Major and Minor. — Cetus.....9.00

ASTRONOMICAL DIAGRAMS.

In a Set of Thirty-Three Inch Sliders, Double Glass, each Diagram framed separate.

No.

1. System of Ptolemy.
2. ——— Copernicus.
3. ——— Tycho Brahe.
4. ——— Newton.
5. Telescopic View of the Moon.
6. Ditto at three different periods of its increase.
5. Ditto of Venus, with Phases, (three Views.)
5. Ditto of Mars.
6. Ditto of Jupiter.
7. Ditto of Saturn.
8. Comparative Sizes of the Planets.
8. Ditto, the colored Circle representing the Sun.
9. Comparative Distances of the Planets.
10. Orbit of a Comet.
11. Comet of 1811.
12. Signs of the Zodiac.
13. Inclination of the Planets' Orbits.
14. Direct and Retrograde Motion.
16. The Seasons.
17. Phases of the Moon.
18. The Earth's Shadow.
19. Cause of the Sun's Eclipse.
20. Ditto Moon's ditto.
21. Inclination of the Moon's Orbit.
27. The Constellation Orion.
28. ——— Ursa Major.
29. Various Nebulæ.
30. A Portion of the Milky Way.
30. A Diagram to show *Meridians*, *Parallels*, and *Circles*.
30. A Diagram, showing the various Zones. 35.00

REVOLVING ASTRONOMICAL DIAGRAMS.

THE MOTION PRODUCED BY RACK-WORK.

In a Set of Nine Sliders, packed in Box, with a Lock.

SLIDER I.

The Solar System, showing the Revolution of all the Planets, with their Satellites round the Sun.

SLIDER II.

The Earth's annual Motion round the Sun, showing the Parallelism of its Axis, thus producing the Seasons.

SLIDER III.

This Diagram illustrates the cause of Spring and Neap Tides, and shows the Moon's Phases, during its Revolution.

SLIDER IV.

This Diagram illustrates the apparent direct and retrograde Motion of Venus or Mercury, and also its stationary Appearance.

SLIDER V.

A Diagram to prove the Earth's Rotundity, by a Ship sailing round the Globe, and a line drawn from the eye of an observer placed on an eminence.

SLIDER VI.

This Diagram illustrates the eccentric Revolution of a Comet round the Sun, and shows the appearance of its Tail at different points of its Orbit.

SLIDER VII.

The diurnal Motion of the Earth, showing the Rising and Setting of the Sun, illustrating the cause of Day and Night, by the Earth's Rotation upon its Axis.

SLIDER VIII.

This Diagram illustrates the annual Motion of the Earth round the Sun, with the monthly Lunations of the Moon.

SLIDER IX.

This Diagram shows the various Eclipses of the Sun, with the Transit of Venus; the Sun appears as seen through a Telescope, ...35 and 40

REVOLVING DIAGRAMS.

Set of Eleven Sliders, including the above, with addition of Two Sliders.

SLIDER X.

This Diagram illustrates the different eclipses of the Moon.

SLIDER XI.

This Diagram shows the eclipses of Jupiter's Moons as seen by Telescope. ..40.00

Chromatropes, or Artificial Fire Works; these sliders are very singular, and the effect similar to the Kaleidoscope. These pictures are produced by brilliant designs being painted on glasses made to rotate quickly or slowly, forward and backward. In great variety, 4.00 to 6.00

Comic Sliders; movable, a large variety, each 1.25 to 2.50

Set Select Humorous Subjects, in 12 sliders, 36 pictures, with descriptions,. 24.00

The Bottle; by Cruikshank, 8 sliders, ... 45.00

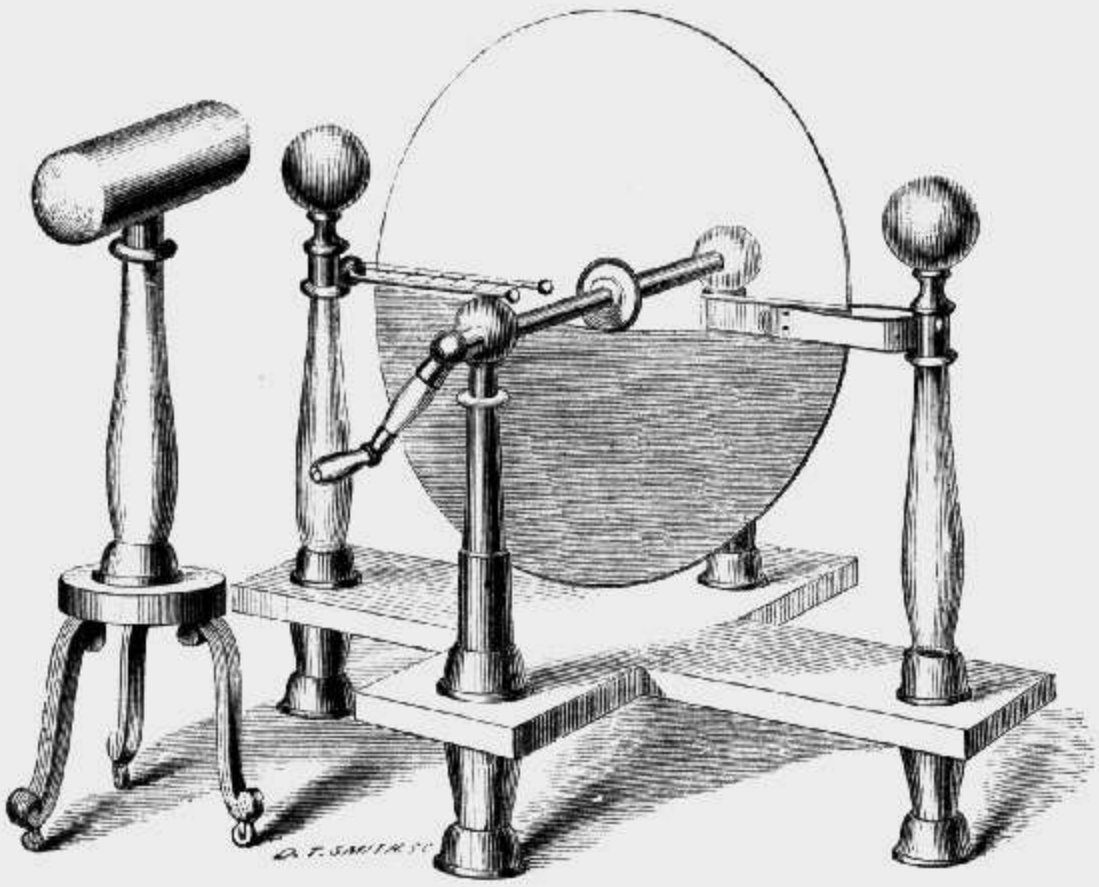
Long Moving Sliders; with shipping, &c., 2.50 to 5.00

Beautifully painted Views; on two and a half and three inch glass. Average price 4.50 and 6.00

Sliders or Paintings. I keep a variety of beautiful paintings for single lanterns, or for dissolving views, both in single sliders or in pairs, or sets, viz., Scriptural Subjects, Landscapes, Views, Buildings, Interiors, &c., of 2½ and 3 inches diameter, painted by the best American and English Artists, at prices from 2.50 to 10.00 each. The average price of superior 3 inch paintings is 5.50

I can furnish to order, paintings of any size or subject.

ELECTRICITY.



No. 2–5.

THE Electrical Machine is constructed upon the most approved principle. The rubbers and prime conductor are each insulated, so that positive and negative electricity may be experimented with. I have made improvements in the rubber, greatly increasing the power of the instrument. In the larger machines the amalgam is spread upon a film of netted silk, with a cushion of finest wool felt.

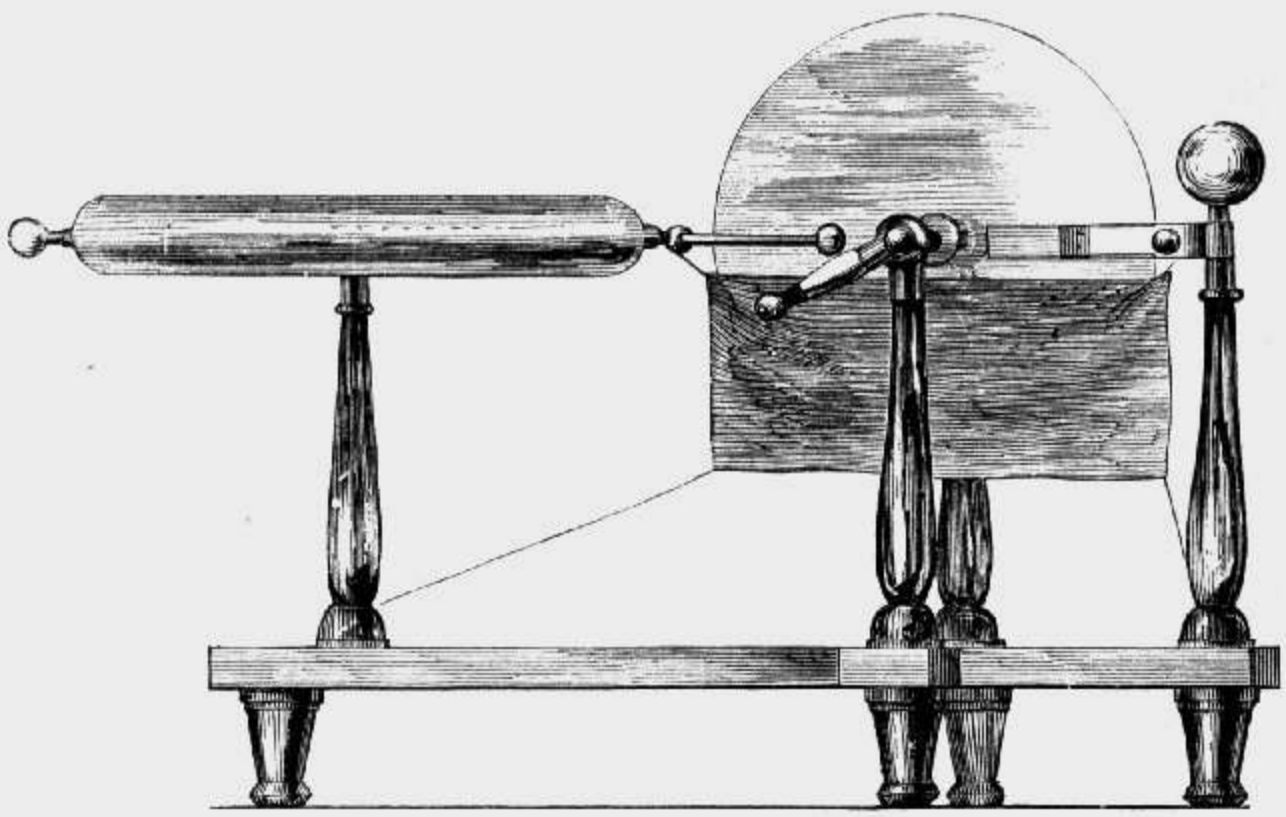
The Prime Conductor is supported upon its pillar by conical fittings, so that it is very firm, yet easily removed. I have made a series of experiments with glass plates, from the French and English manufactories, to decide which is best for excitation, and the least affected by hygrometric states of atmosphere; and I have imported directly the plates for all sizes of instruments.

The Basements will in future be made of rosewood or best St. Domingo mahogany, varnished, rubbed, and polished.

In the large machines, it is very desirable to have the large conductor on a separate basement. It is much more convenient. It can be attached to either the positive or negative balls. In many experiments its use is not required.

Electrical Machines, with plates of larger dimensions, will be made to order. I have made one for the University of Mississippi with two plates of six feet diameter each, with four pairs of rubbers, elaborately finished.

Cut Glass Pillars will be put upon Nos. 2 to 7, at additional cost of $6 to $15, which add to the beauty of the instrument without injury to its strength or efficiency.



No. 5–9.

NUMBER PRICE

1. Electrical Machine; rosewood basement, with two plates, 48 inches in diameter, four pair 15 inch improved rubbers, prime conductor 66 by 8 inches on separate basement, six insulated pillars, insulated crank, highly finished, ... $300.00
2. Electrical Machine; rosewood basement, plate 54 inches in diameter, rubbers 18 inches, positive and negative balls 8 inches diameter, prime conductor 66 by 8 inches mounted upon a separate basement, insulated crank,..... 225.00
3. Electrical Machine; mahogany basement, plate 48 inches in diameter, rubbers 15 inches, positive and negative balls 8 inches in diameter, prime conductor 60 by 8 inches on separate tripod basement, insulated crank, ... 175.00
4. Electrical Machine; mahogany basement, plate 42 inches in diameter, rubbers 13 inches, positive and negative balls 8 inches, prime conductor 54 by 8 inches on tripod basement, insulated crank,..... 160.00

4*a*. Electrical Machine, with same dimensions, with the prime conductor upon same basement, ... 135.00

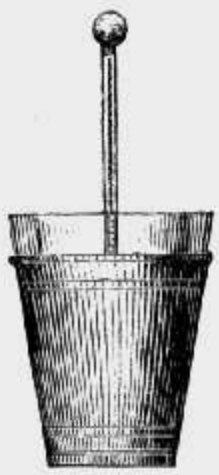
5. Electrical Machine; mahogany basement, plate 36 inches in diameter, rubbers 12 by 2 inches positive and negative balls 7 inches, prime conductor 48 by 7 inches, on tripod basement with casters, insulated crank, ... 150.00

5*a*. Machine with same dimensions, with the prime conductor mounted on same basement,..... 125 00

6. Electrical Machine; polished mahogany basement, 5½ by 3 feet; plate 30 inches diameter; prime conductor 40 by 6 inches, with double separable set of points mounted on conical fittings; Ritchie's improved felt rubbers, insulated crank; the shaft is elevated 44 inches

No. 10.

No. 11.



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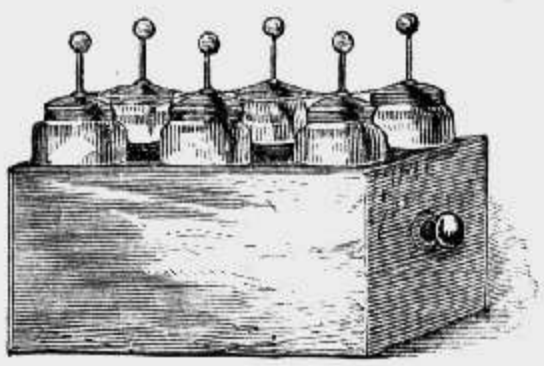
No. 14.

No. 15.



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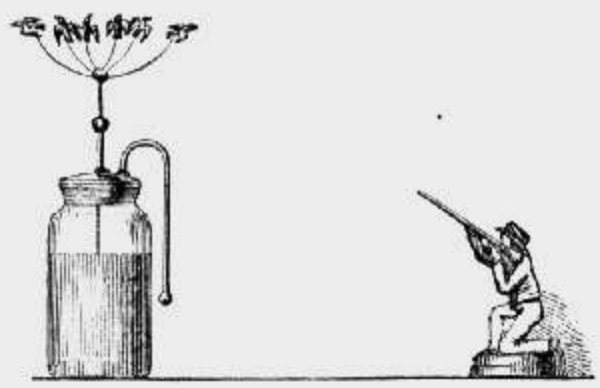


No. 17.

NUMBER. PRICE.

from the floor; finely finished. This instrument has been highly approved, and is very efficient, ... $100.00

7. Electrical Machine, of same dimensions as No. 6, but mounted like No. 4, ... 125.00

8. Electrical Machine; mahogany basement, plate 24 inches, rubbers 8 by 1½ inches, prime conductor 21 by 4½ inches, negative do. 4½ inches; the basement is 52 by 25 inches, the shaft is elevated 28 inches above the table, ... 50.00

9. Electrical Machine; mahogany basement, 40 by 19 inches; plate 20 inches in diameter; prime conductor 18 by 4 inches, with improved screw mountings upon the insulated pillar; negative ball 4 inches, finely finished, ... 30.00

10. Electrical Machine; polished mahogany basement, 35 by 17 inches; plate 16 inches diameter; prime conductor 15 inches, with improved mountings upon the insulated pillar; negative ball 4 inches, finely finished, ... 25.00

11. Leyden Jars; 2, 3, 4, and 8 pints, 1.00, 1.50, 2.00, and 3.00

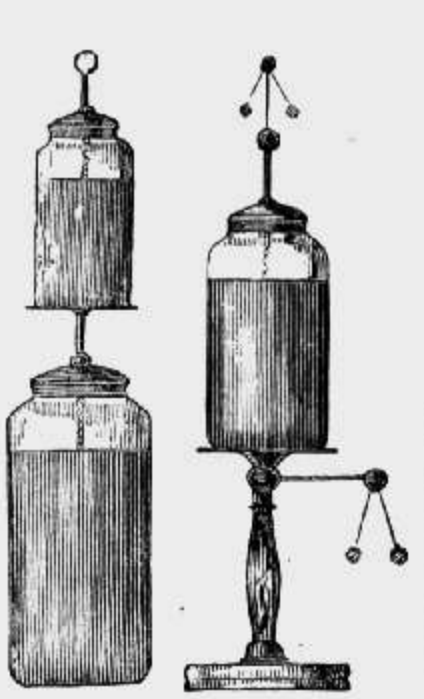
12. Atmospheric Leyden Jar; with crooked stem and ball for suspension, movable ring with points; one quart, 2.00; two quarts, ... 3.00

13. Leyden Jars; improved form, with movable coatings; one and two quarts, 2.50 and 3.50

14. Electrometer Jars; one and two quarts, 1.50 and 2.50

15. Diamond or Luminous Jars; the spots are perforated to show the points on both sides; two and four quarts, 3.00 and 5 00

16. Electric Batteries; mahogany lined cases; four 1 quart jars, 6.00; six 1 quart jars, 8.00; four 2 quart jars, 10.00; six 2 quart jars, 14.00; four 4 quart jars, 12.00; six 4 quart jars, ... 18.00



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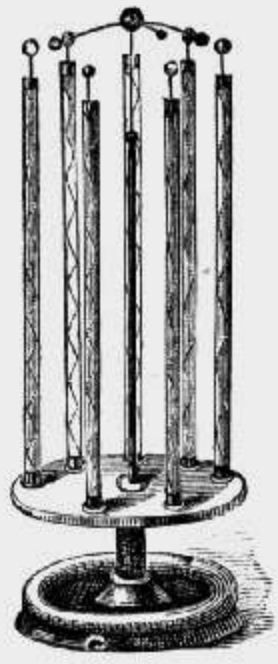

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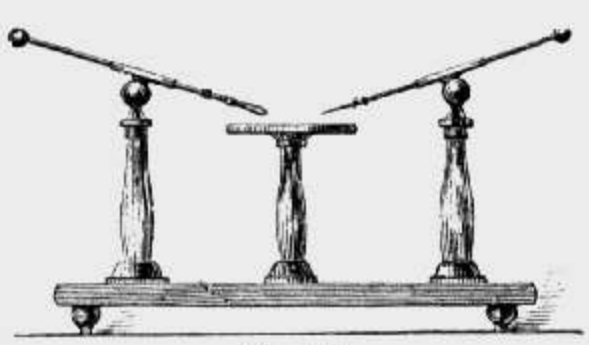
No. 25.

No. 27.

No. 28.

No. 29.

NUMBER		PRICE
17.	Electric Sportsman and Birds; used with electrometer jar, 75 and....	1.00
	Electric Birds; per dozen, 50 cents and	.75
18.	Double Leyden Jars; one and two quarts; illustrates several important principles,.....	3.50
19.	Insulating Stand for jar, and electrometers,.....	4.00
20.	Improved Set of Leyden Jars; two quart jar fitted as electrometer jar, a plate which screws upon the stem in place of the ball supports a one quart jar with atmospheric ring; the set answers for Nos. 11, 12, 14, and 18,.....	4.50
21.	Leyden Jar; with outer coat of filings, showing the zigzag lines of the current; one, two, three, and four quarts; 1.25, 2.00, 2.50,.....	3.00
22.	Spiral Spotted Tube and Stand; two feet, 2.50; three feet,.....	3.50
23.	Set of Six Spiral inside Spotted Tubes; with centre insulated pillar, and revolving discharger mounted on mahogany stand; with two feet tubes, 20.00, three feet,.....	25.00
24.	Electric Spoon; for igniting ether, 75 cents,.....	1.25
25.	Insulated Conductor; stand and electrometers, for induction by influence,.....	12.00
26.	Insulated Director, or Discharger; with ball and point, 1.50 and	2.00
27.	Plain Discharger; large glass handle, 2.00 and	2.50
28.	Jointed Discharger; large handle, best form, ...	3.50



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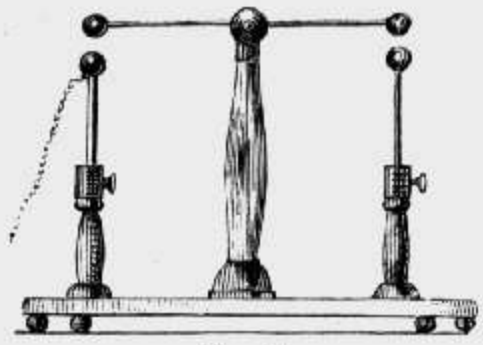

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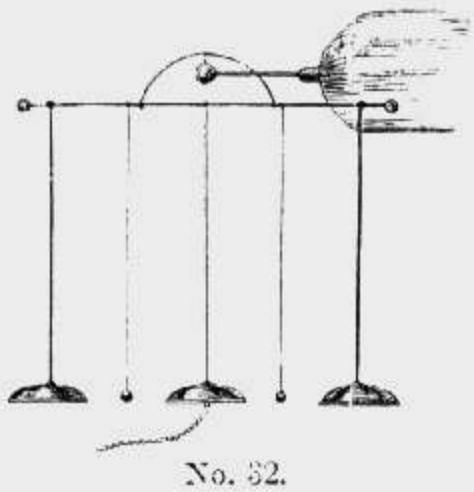

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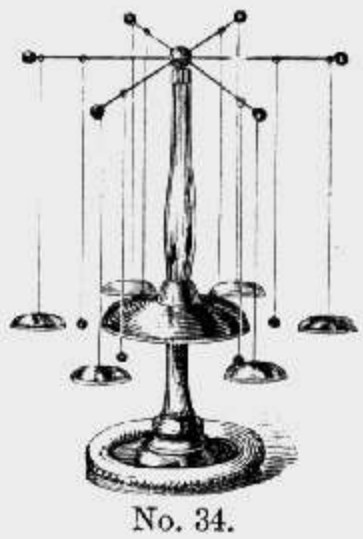

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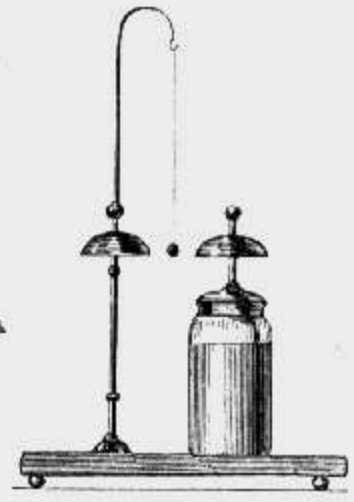

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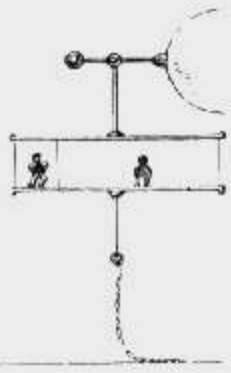

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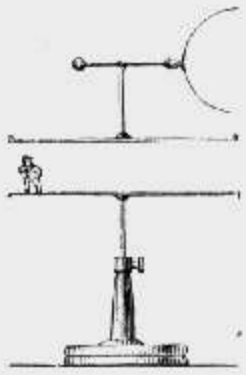

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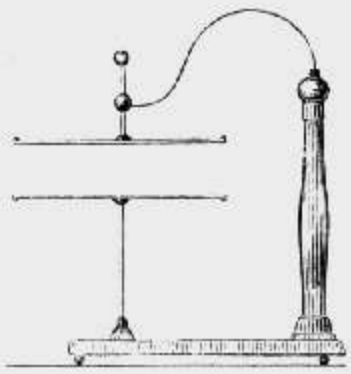

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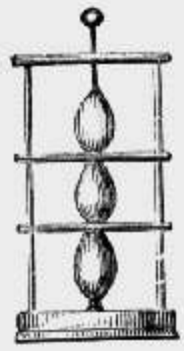


No. 39.

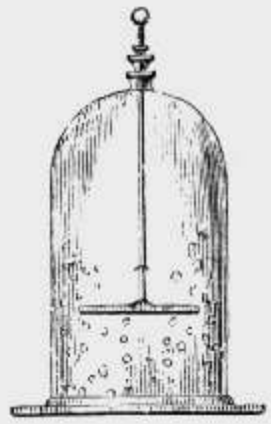
NUMBER		PRICE
29.	Jointed Discharger; with two handles,	3.50
30.	Universal Discharger; large insulated table, swelled pillars with universal joints, sliding rods with balls, points, and pincers; mahogany basement, 6.00 and	8.00
31.	Balance Electrometer; 16 inch beam, adjustable; for measuring attraction and repulsion, and for the gradual discharge of a Leyden jar,	4.00
32	Electrical Bells; set of three 3 inch bells, with frame, to suspend to conductor,	3.00
33.	Set of Five Bells; on insulated stand handsomely mounted,	9.00
34.	Set of Nine Bells; mounted on mahogany stand, with large insulating pillar; very handsomely mounted,	12.00
35.	Leyden Jar; with bells and stand,	5.00
36.	Dancing Image Plates; eleven inches diameter, to suspend to prime conductor,	2.00
37.	Dancing Image Plates; eleven inches, on adjusting stand,	3.00

No. 41.

No. 42.

No. 43.

No. 44.



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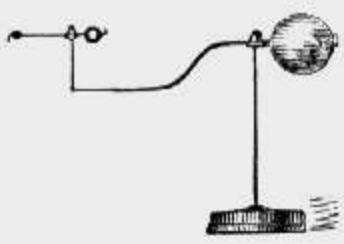

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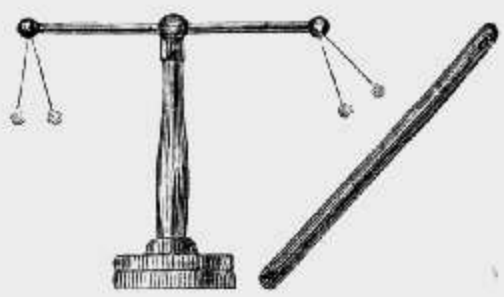
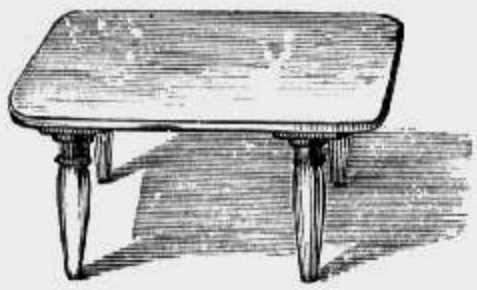


No. 53.

NUMBER		PRICE
38.	Dancing Image Plates; on insulating and adjusting stand, 4.00 and...	6.00
39.	Stand for Illuminating Eggs; 1.50 and.....	3.00
40.	Dancing Images; of pith, painted, per pair.....	.50
41.	Pith Ball Electrometer and Stand, 50 cents, 75 cents, and	1.00
42.	Quadrant Electrometer and Stand, 2.00 and	3.00
43.	Gold Leaf Electrometer with evaporating cup and point, 2.00 and	3.00
44.	Improved Gold Leaf Electrometer; with evaporating cup, point, and condensing plates: brass stand; very sensitive.....	5.00
45.	Atmospheric Electrometer; with air thermometer.....	6.00
46.	Plate to attach to sliding rod for dancing pith balls,.....	.50
47.	Electrical S. (or Flier) and Stand; with four points, 50 cents; eight points,.....	.75
48.	Compound Electric S: with point and insulated stand, 2.00, and.....	3.00
49.	Electric Seasons Machine, with point and stand; is placed in the centre hole of the prime conductor, ...	1.50
50.	Electric Seasons Machine, or Tellurian; mounted on insulated stand, large size,.....	6.00
51.	Electric Seasons Machine; mounted on insulating stand, smaller size,	3.00
52.	Sulphur Cone and Cup; 75 cents and	1.50
53.	Insulated Bar, with electrometers, to illustrate induction by influence, ...	4.50
54.	Insulating Stool; mahogany, 16 inches square, and braced, large swelled glass legs with brass screw caps 8 inches high, finely finished,	6.00
55.	Insulating Stool; 16 inches square swelled legs; neatly finished, ...	4.50
56.	Revolving Bell Glass; with point and movable ring, 2.00 and...	2.50



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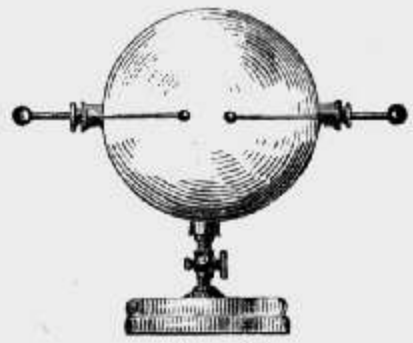

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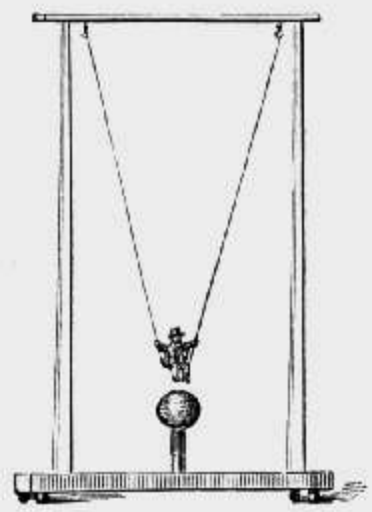

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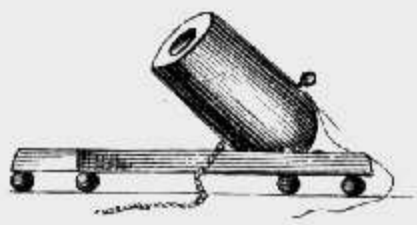

No. 65.

No. 66.

NUMBER		PRICE
57.	Globe with Sliding Rods, Cocks, and Stand; for passing the current through vacuum, gasses, &c.; globe 10 inches diameter,	8.00
58.	Miser's Plate; 12 and 16 inches square; plain, 75 cents and 1.00; in mahogany frame, 1.50 and	2.00
59.	Luminous Bell; two sets of points to attach to pump plate, and to the sliding rod; for the points, 1.00,	1.50
60.	Electrophorus; eleven inches, with cover and handle,	6.00
61.	Electrophorus: eleven inches, mounted on insulating stand, with cover, and handle, and elastic bag and jet, 6.00 and	8.00
62.	Electric Swing and Image, 2.00 and	3 00
63.	Ivory Mortar and Ball; 2.00 and	3.00
64.	Electrical Cannon; mounted in brass,	4.00
65.	Powder Bomb; illustrates the effect of passing the current through water,	1.25
66.	Electric Swan and Basin; 1.00 and	2.00
67.	Northern Light, or Aurora Tube; from three to eight feet long, and mounted, 4.00 to	10.00

NOTE. — See Guinea and Feather Tube in *Pneumatics.*

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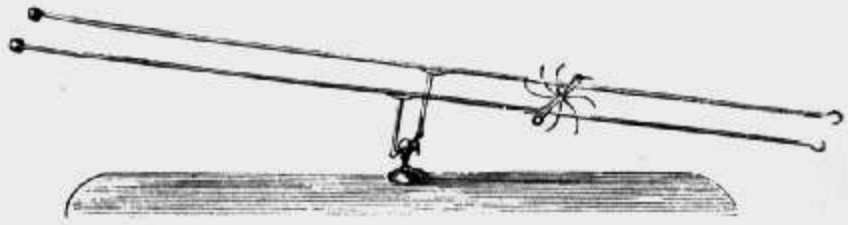

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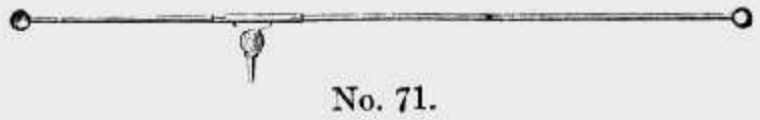

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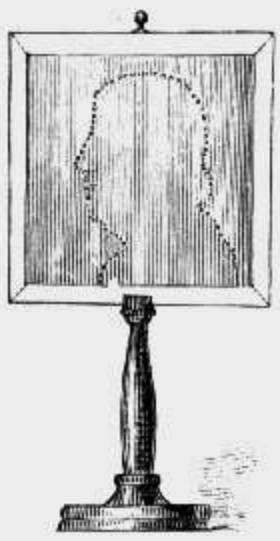

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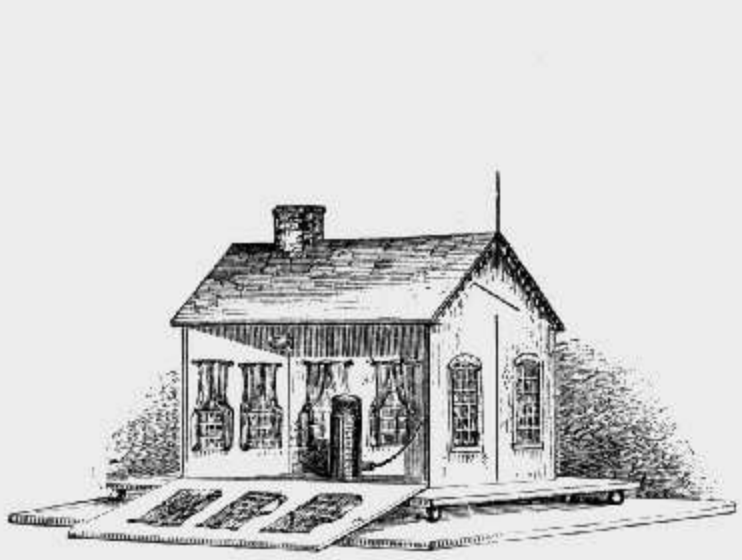
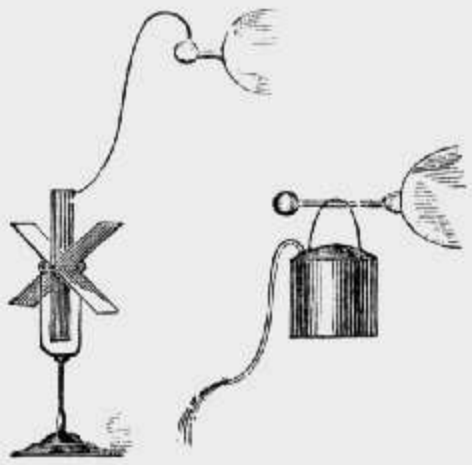


No. 76.

No. 77.

NUMBER		PRICE
68.	Brass Electrical Gas Pistol; with curved mahogany handle; fitted also for voltaic pistol,	4.00
69.	Electrical Gas Pistol; plain,	.50
70.	Electric Wheel and Inclined Plane; 2.00 and	4.00
71.	Sliding Directing Rod; three and four feet long, 2.00 and	3.00
72.	Luminous Letters; six and twelve inches square, on glass and in frame; *seen by day or night;* per letter, 50 cents and	.75
73.	Luminous Star; on glass, mounted, 2.50 and	4.00
74.	Profile of Franklin; spotted on glass, and mounted, 2.50 and	4.00
75.	Illustration of the Leyden Jar; plate of glass, with coatings and electrometers on each side, mounted like No. 74,	4.00
76.	Thunder House; illustrating the lightning rod; the house is held together by magnets, and is blown down by the discharge of a gas pistol within; complete. 5.00 and	6.00



No. 78.

No. 79.

No. 80.

No. 81.

NUMBER		PRICE
77.	Hydrogen Gas Generator; (see *Chemistry.*).....	3.00
78.	Electric Float; wheel and point, 1.00, ...	1.50
79.	Electric Siphon and Bucket, 1.00 and	2.00
80.	Abbe Nollet's Globe; bell glass with thick glass globe and loose cap to admit water; to be placed on plate of air pump, showing very beautiful and varied effects; six quart bell, 6.00; four quart bell,.....	4.00
81.	Globe; with sliding rods, stop cock and stand, or Electric Egg,.....	8.00
82.	Coulomb's tortion Electrometer, for accurately measuring small quantities of electricity, ...	25.00
83.	Electrical Gamut of eight bells with revolving clapper, 12.00 and.....	15.00
84.	Apparatus for igniting phosphorus, 3.00 and.....	4.00
85.	Model of Obelisk to illustrate the lightning rod, ...	3.00
86.	Apparatus for piercing a card or plate of glass, by the discharge of a Leyden Jar,.....	5.00
87.	Hollow Sphere of Coulomb to show that the electricity resides on the exterior surface — globe, 5 inches diameter on insulating pillar and mahogany basement; an opening in the top admits the test needle,..	7.00
88.	Test needle; a slender rod of glass or gum lac, with disk of gold foil,	.50
89.	Apparatus for illustrating the tension of electricity; four brass insulated globes of diameter one to four inches, adjustable at different distances, on mahogany basement, 8.00 and	10.00
90.	Condenser, two insulated disks of brass, movable on mahogany basement,.....	7.50
91.	Apparatus to illustrate the theory of the Leyden Jar; two disks of metal with insulated handles and plate of glass, 4.00 and.....	5.00
92.	Apparatus for passing the charge of a jar or battery through water, insulated pillars with sliding rods, gutta percha basins and mahogany basement,.....	5.00
93.	Artificial Spider, for attraction and repulsion,.....	.50
94.	Brass Ball, on insulating stand,.....	1.00
95.	Apparatus for Decomposing and Recomposing Water; strong glass receiver capped at each end, with sliding rods and balls; insulating stand, with graduated jar measuring the gases evolved by the water displaced; the balls are movable to admit platinum points for galvanism, (see *cut in Magnetics,*).....	8.00
96.	Amalgam; per box 25 cents and.....	.50

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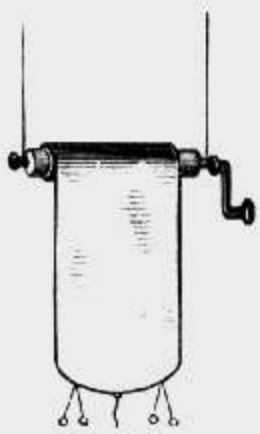

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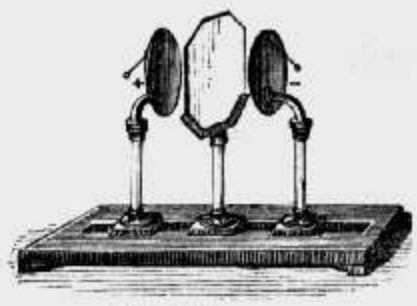

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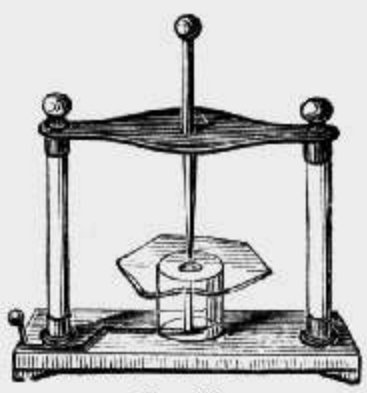

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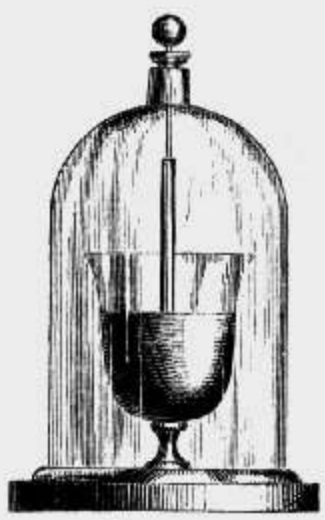
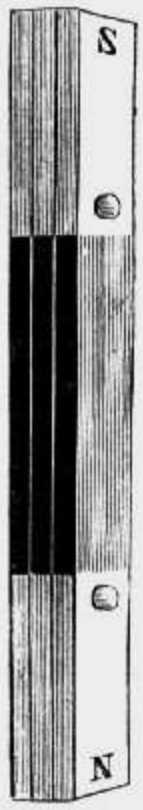


No. 101.

NUMBER. PRICE

97. Faraday's Muslin Bag; sustained upon an insulated ring of wire, with silk strings,..... $4.00
98. Apparatus illustrating the relation of Surface and Intensity; a metallic ribbon wound upon a metal shaft, with electrometers, ... 3.50
99. Condenser of Æpinus; mahogany basement, with movable insulating glass pillars, supporting two brass discs, with electrometers and an intermediate glass plate,..... 16.00
100. Ellipsoidal Conductor, showing the Unequal Distribution of Electricity; of brass, supported on glass pillar and basement,..... 15.00
101. Gassiot's Cascade; consists of a glass vase coated on the inside, and a glass tube through which a sliding rod passes to connect with the inner coating; it is used under a bell glass. Connect the knob of the sliding rod with the prime conductor, or to one terminal of the Ruhmkorff coil, the opposite wire being connected with the pump plate, the flow of electricity is very beautiful in a darkened room,..... 1.50
102. Gassiot's Cascade, of Uranium Glass,..... 2.00
103. Lightning Plate; covered on one side by brass filings, the reverse with tin foil, 1.50 to..... 3.00
104. Head of Hair, or Long-haired Man; 75 cents and..... 1.00
105 Pith Balls; per dozen, plain and striped, 25 cents to..... .75
106. Geissler's Tubes. (See *Induction Apparatus*, MAGNETICS.)

MAGNETICS.



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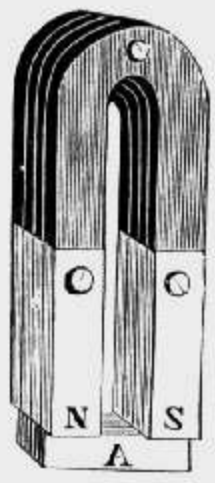

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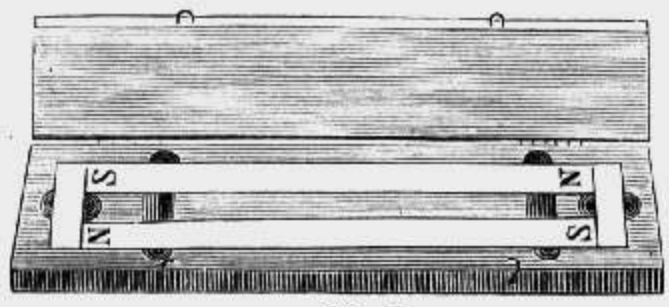

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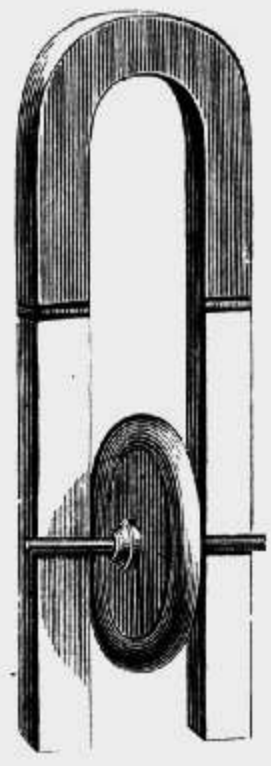
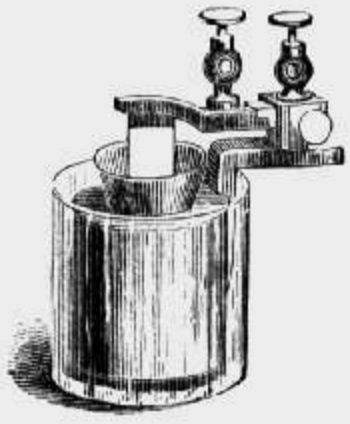


No. 6.

NUMBER.		PRICE.
1.	Single Bar Magnet and Keeper, 50 cents, 75 cents, and	$1.00
2.	Pair of Bar Magnets and Armature; in box, ten inch,	3.00
3.	Compound Bar Magnet; twelve inch,	2.50
4.	U Magnet and Armature; 50 cents, 1.00, and	1.50
5.	Compound Horse-shoe or U Magnets; of three or more magnets combined, 3.00, 5.00, 8.00, and	12.00
6.	Wheel Armature; revolves on U magnet; 50 cents and	.75
7.	Bar, Star, and Y Armature,	.50
8.	Magnetic Needle; brass stand and point,	1.00
9.	Dipping Needle; four inch needle on brass stand,	2.50
10.	Dipping Needle; with graduated arc,	5.00
11.	Dipping Needle; mounted on brass basement and pillars, with levelling screws with agate centre bearings; the needle is carefully balanced before being magnetized; the inclination is indicated by a graduated arc; accurately and finely finished,	15.00
12.	Astatic Needle; on stand,	2.00
13.	Pocket Compass; agate centre; in brass box, 2.00 and	3.00
14.	Pocket Compass; in mahogany box, 1.50 and	2.00
15.	Magnetic Toys; fish, swans, ship, &c., 25 cents to	.75
16.	Natural Loadstone; in box, 25 cents and	.50
17.	Frog Battery; of silver and zinc, insulated by a wooden bar,	.75
18.	Thermo-Electric Plates; pair, 25 cents; series,	2.00
19.	Bar Magnets; for breaking; each, 12 cents and	.17



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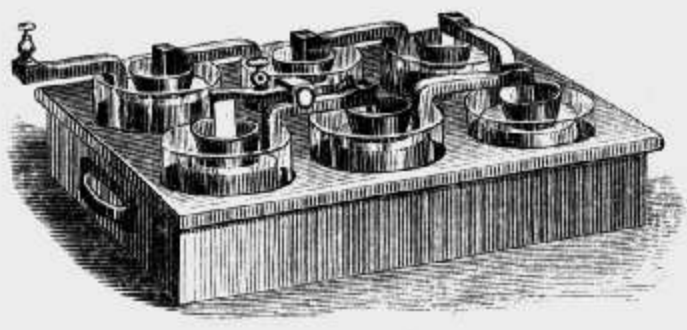

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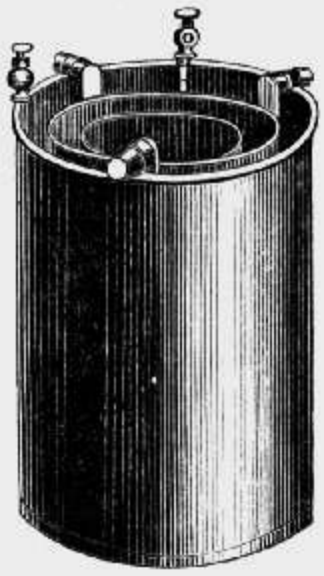

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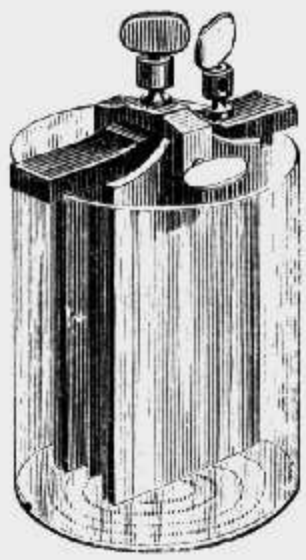

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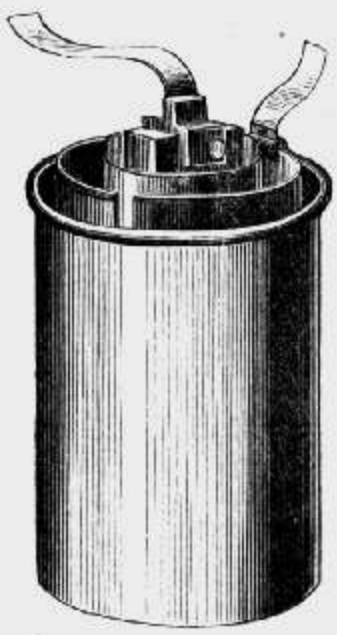
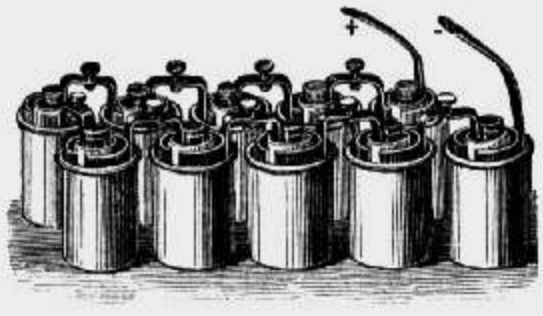
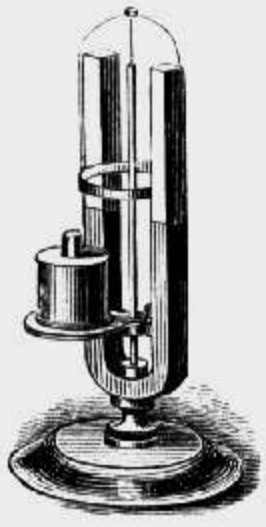


No. 28.

NUMBER.		PRICE.
20.	Grove's Battery; of improved form; single cell,	$2.50
21.	Grove's Battery in Box; with four, six, and twelve cups; per cell,	2.00
22.	Sulphate of Copper Battery; 8 by 9½ inches,	8.00
23.	Sulphate of Copper Battery; 6 by 9 inches,	6.00
24.	Sulphate of Copper Battery; 4 by 5½ inches,	3.00
25.	Smee's Battery; of improved form; 7 by 5½ inches,	3.25
26.	Smee's Battery; form of Grove's cell,	2.00
27.	Plate Battery; of fifty and one hundred pairs of heavy zinc plates, in copper cells; mahogany frame; windlass and crank, 45.00 and	85.00
28.	Bunsen's Battery; cell 9 by 5 inches, solid carbon, with improved screw clamp connections,	3.00
	No. 28 A exhibits a Battery of Bunsen's Cells, arranged for intensity; by connecting all the carbons to a copper ribbon, and all the zincs to a ribbon, it becomes a *quantity* battery.	
29.	Bunsen's Battery; extra large size, carbon 15 inches long, by 3½ inches wide and 1½ thick; zincs 5 inches in diameter; in stone jars with cover and handles,	7.00



No. 28 A.



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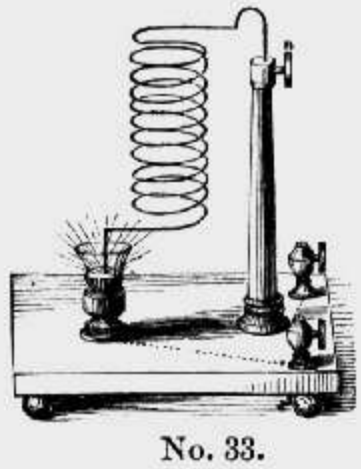

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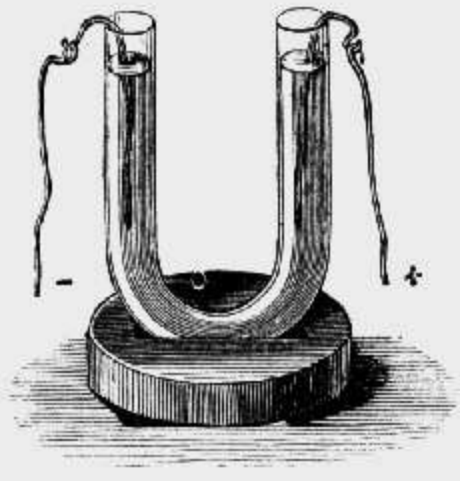

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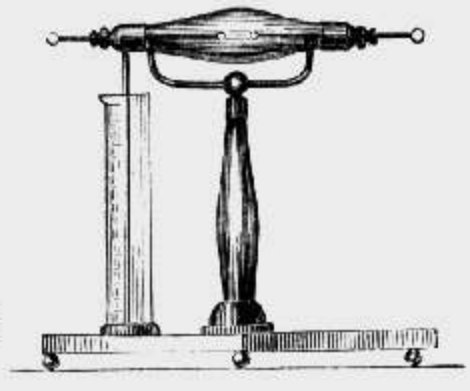
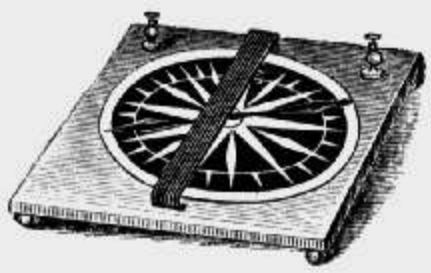


No. 35.

No. 36.

NUMBER.		PRICE
30.	Thermo Electric Revolving Arch,	$5.00
31.	Thermo Electric Arch; between the poles of an electro magnet,	6.00
32.	Double Thermo Electric Arch,	6.00
33.	Contracting Helix; mahogany base and pillar; copper helix,	3.50
34.	Apparatus for Electrolysis of Salts; bent tube upon a base with platinum electrodes,	3.50
35.	Apparatus for Decomposing and Recomposing Water; a strong glass receiver, capped at each end, with sliding rods and platinum electrodes; basement and pillar with graduated jar to measure the gas evolved by the displacement of water; to recompose, pass the electric spark through the gas,	8.00
36.	Decomposing Cell; with graduated tubes and platinum electrodes, 3.00 and	3.50
37.	Powder Cup; improved, glass or brass cup, 50 cents and	1.00
38.	Voltaic Pistol; for gas, 2.50 and	3.00
39.	De La Rive's Ring, or Floating Battery; 1.00 and	1.50
40.	Magnet revolving round a Conductor,	6.00
41.	Magnet revolving on its Axis,	5.00
42.	Revolving Wire Frames; two light copper wire frames revolving round the poles of a U magnet,	8.00
43.	Vibrating Wire; mahogany basement with magnet, pillar, mercury cup, and wire,	5.00
44.	Revolving Spur Wheel; magnet and basement,	6.00



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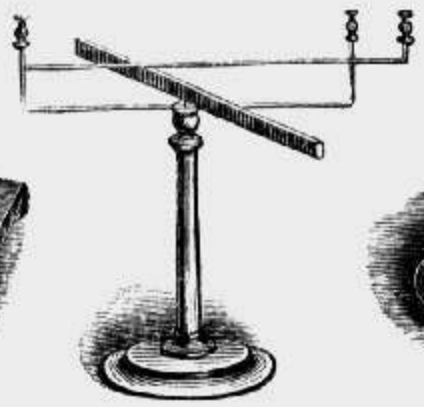

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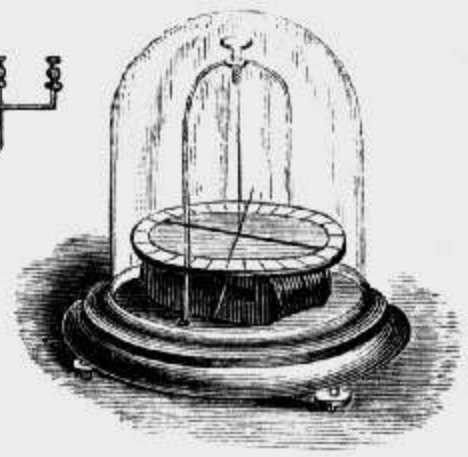

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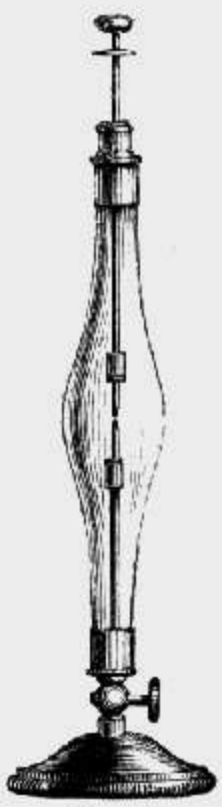

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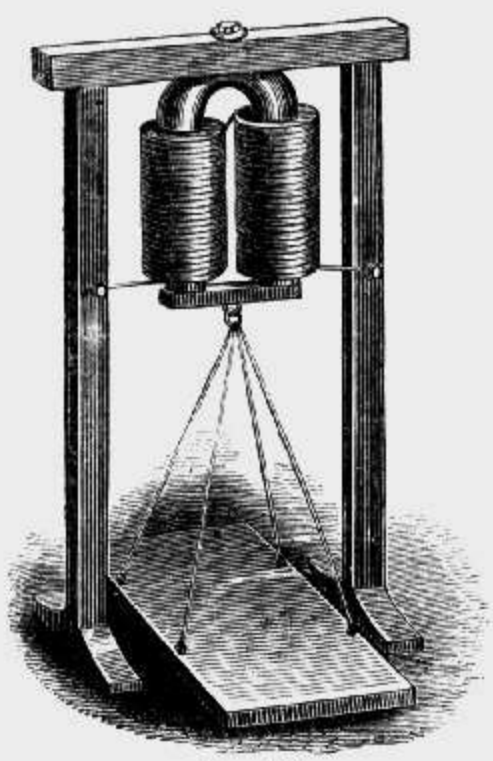

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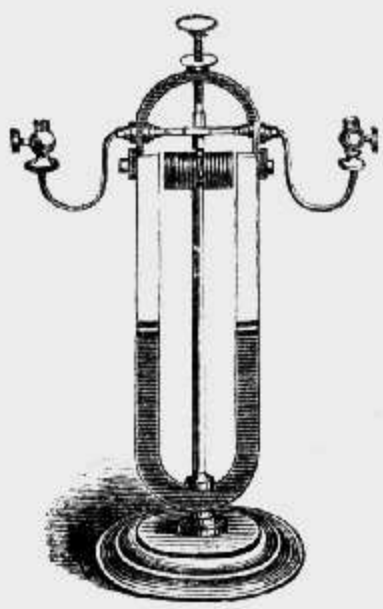
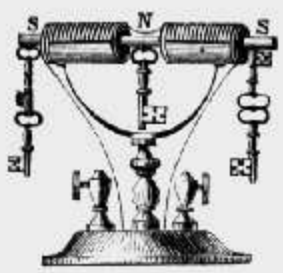


No. 55.

NUMBER.		PRICE.
45.	Revolving Rectangle; rectangular helix between the poles of a U magnet,	$6.00
46.	Attracting and Repelling Wires,	3.50
47.	Galvanometer; compass form, 2.50 and	3.00
48.	Upright Galvanometer; on tripod, with levelling screws,	5.00
49.	Oersted's Galvanometer; 3.00 and	3.50
50.	Galvanometer, with Astatic Needle; 5.00 and	6.00
51.	Galvanometer; very sensitive; astatic needle suspended by a fibre of silk; basement with levelling screws and glass bell,	30.00
52.	Apparatus for the Electric Light in a Vacuum; glass globe with stop-cock; sliding rods with carbon holders,	8.50
53.	Electro Magnet; of soft iron, with helix of insulated copper wire, 1.00, 1.50, 2.00, and	3.00
54.	Electro Magnet; in frame, 8.00, 15.00, and,	25.00
55.	Page's Revolving Electro Magnet,	5.00
56.	Flat Spiral; a ribbon of copper, insulated and coiled into a spiral, with pole screws; per lb.,	1.00
57.	Globe and Coil; with magnet and dipping needle,	4.00



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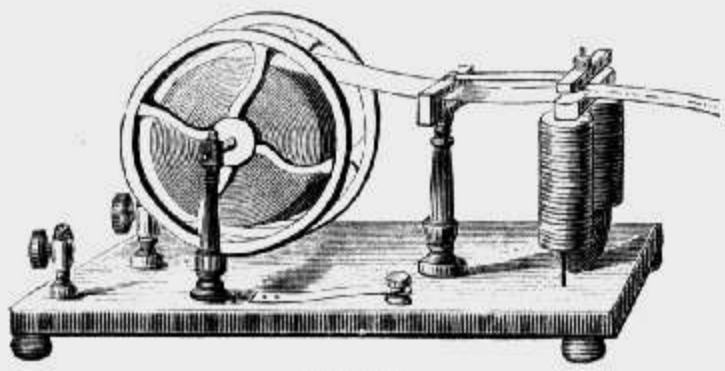

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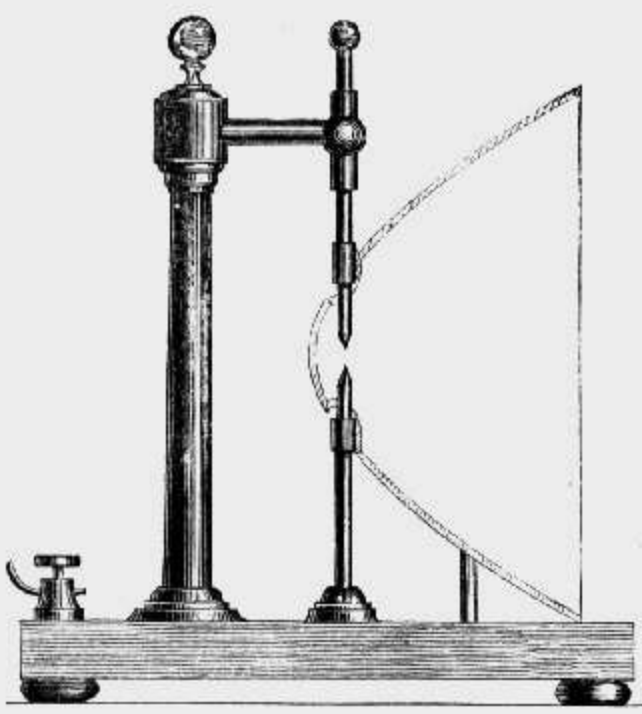

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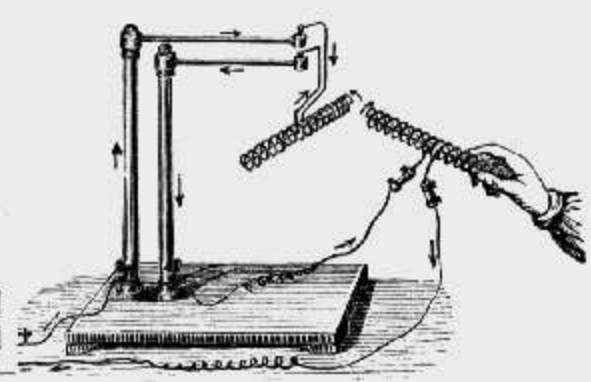
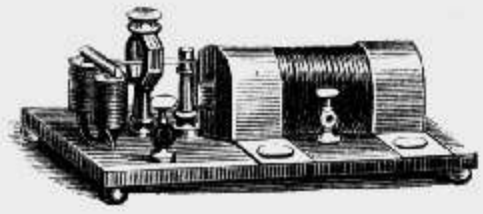


No. 66.

NUMBER.		PRICE.
58.	Helix on Stand, with a Bar of Soft Iron, for showing Magnetic Induction, 2.00 and	$2.50
59.	Electro-Magnet with Three Poles,	3.00
60.	Model of Telegraph, with Spool of Paper and Signal Key Break-piece,	5.00
61.	Heliacal Ring and Semi-circular Armatures with Ring Handles; to show the force of magnetism by induction, 2.50 and	3.50
62.	Heliacal Ring and Armatures; of large size; with ball and socket handles,	5.00
63.	Heliacal Ring; enclosed in double cylindrical armatures,	5.00
64.	Lifting Coil and Rods; for suspension, 1.50, 2.50, and	5.00
65.	Electric Light Apparatus; basement and pillars; silver plated parabolic reflector; adjustable carbon holders; pole cups; nine inch reflector, 20.00; twelve inch,	30.00
66.	Ampère's Frame; mahogany basement; brass pillars and arms with cups; a set of five forms of insulated wire with centre points; a helix or solenoid of insulated copper wire, to place upon the frame; for Ampère's experiments, showing the action of magnets upon the currents, the action of terrestrial magnetism, and the action of currents upon currents,	18.00
67.	Solenoid or Helix; to exhibit the phenomena of attraction and repulsion, as a magnetic bar; when used with No. 66 both helices may be in the same circuit,	1.50



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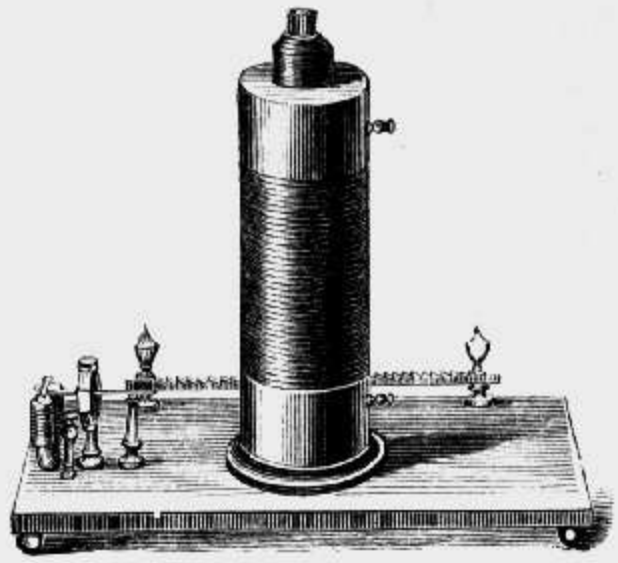

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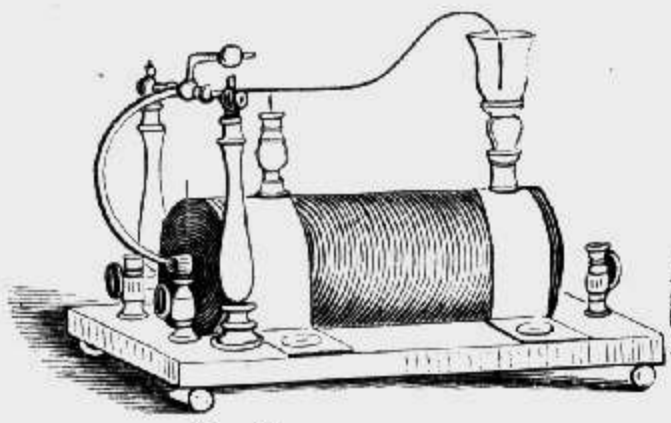

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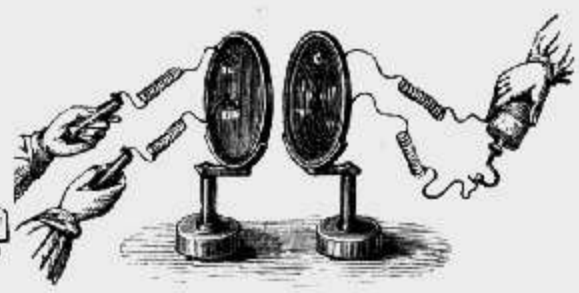
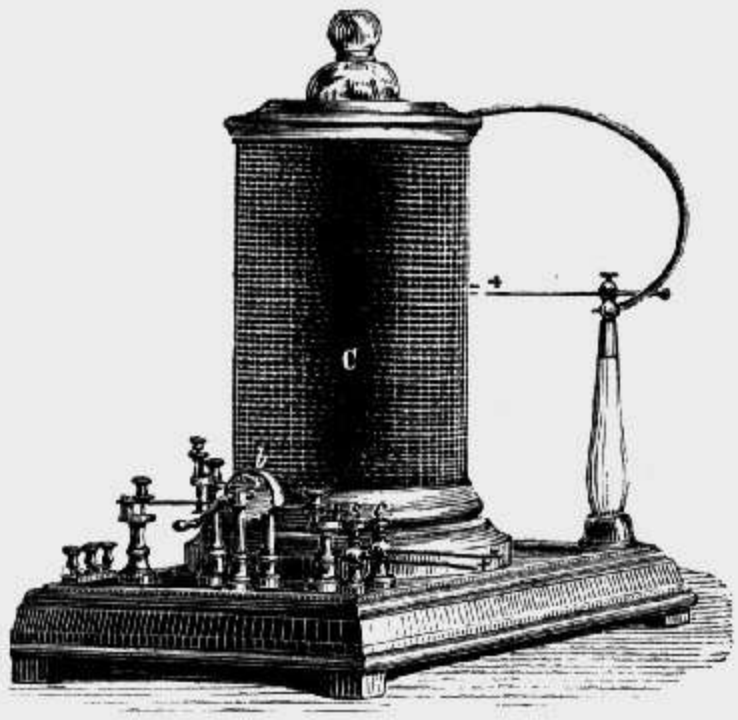


No. 79.

NUMBER.		PRICE.
68.	Carbon Points for Electric Light; per dozen,	$1.00
69.	Signal Key; for connecting or breaking the circuit,	2.50
70.	Vibrating Shocker, or Double Helices; for showing the volta-electric induction of Faraday,	5.00
71.	Analysis of Shocks, or Double Separable Helices; with De La Rive's vibrating electrotome and rasp break-piece,	12.00
72.	Handles for Shocks; cylindrical brass handles,	1.50
73.	Handles for Shocks; with rosewood insulations,	2.00
74.	Sponge Handle; with glass insulation,	.75
75.	Slippers for Shocks; each,	.75
76.	Set of Connecting Insulated Wires; coarse and fine,	.50
77.	Apparatus for Medical Use; battery, shocker, handles, and wires, comp'ete in box, 10.00 and	12.00
78.	Page's Vibrating Armature and Electrotome; 8.00 and	10.00
79.	Matteucci's Apparatus; for showing the phenomena of influence from the voltaic current and from the Leyden jar; two coils of insulated copper wire mounted on stands,	15.00
80.	Apparatus for showing Henry's Secondary Currents of Different Orders; producing an intensity current from a quantity current, and the converse; series of flat spirals of coarse and fine insulated wire; per pair, according to size, from 6.00 to	10.00
81.	Terrestrial Helix; seven inches diameter; to use with magnetic needle,	1.50



No. 82—86.

RITCHIE'S IMPROVED RUHMKORFF COIL.

ONE of the most important instruments which has been brought out for many years is the Ruhmkorff Induction Coil, by which almost all the effects of Static or Frictional Electricity are produced from the Battery. I have improved its construction, increasing greatly the volume of the discharge, and rendering it capable of throwing the sparks several times the length yet obtained in Europe, and reducing the number of cells of the battery.

The instrument consists of a primary coil of copper wire with its core or bundle of iron wire; over this is placed a thick glass cylinder or bell; surrounding this bell is the secondary helix of fine silk-covered copper wire, from three to thirty miles in length, wound upon a cylinder of gutta percha, and carefully insulated; the terminals of the wire, enclosed in rubber tubes, lead to insulated pillars, and the discharges pass between platinum points or balls, or the current is conducted by wires to other apparatus to show its effects.

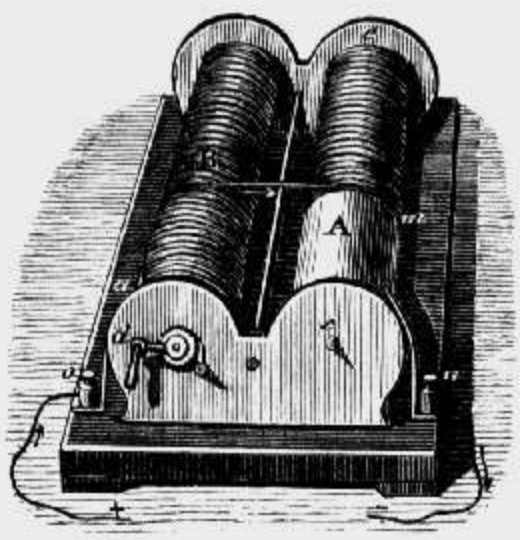
The current from the battery is received through wires by pole cups in connection with the primary helix, and passes through an interrupter or breakpiece; within the basement, and connected with the interrupter, is placed a condenser of alternate sheets of oiled silk and tin foil.

The instrument is mounted upon a mahogany basement; the helix is covered with silk velvet, and rests upon a mahogany pedestal, and is finely finished.

The power of this instrument is immensely greater than the Electrical Machine; the discharges may be made so rapidly as to appear a continuous flow, and with quantity so great that a Leyden jar can be charged and discharged as rapidly as the ear can distinguish sounds, and with almost deafening effect.

This instrument is not affected by the state of the atmosphere, occupies a small space, and is worked without labor; the battery used is Bunsen's Carbon Battery, of intensity of only two to four cells; for fine effects the battery should be of large size, though several of small surface can be united to produce a similar result.

NUMBER.		PRICE.
82.	Induction Coil; basement 24 by 18 inches; helix 10 inches in diameter; height 28 inches; capable of throwing the spark 15 inches, ...	$400.00
83.	Induction Coil; basement 24 by 17 inches; helix 10 inches diameter; throwing the spark 12 inches,.....	350.00



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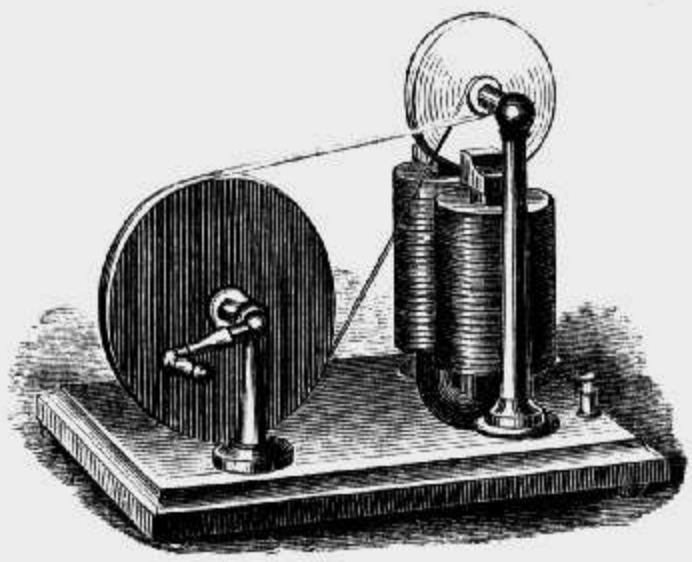


No. 89.

NUMBER. PRICE.

84. Induction Coil; basement 22 by 14 inches; helix 9 inches in diameter, throwing a spark 9 inches, ... $275.00

85. Induction Coil; basement 22 by 12 inches; helix 8 inches diameter; throwing the spark 6 inches, ... 225.00

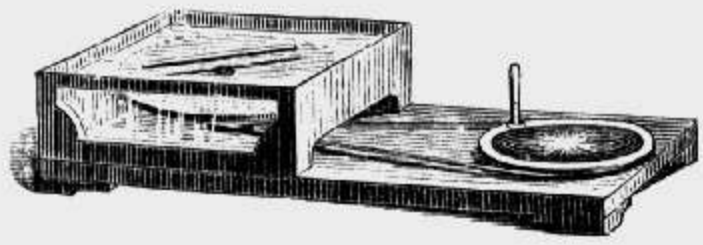
86. Induction Coil; basement 20 by 11 inches; helix 8 inches diameter; throwing the spark 4 inches, ... 150.00

With this instrument are used all the pieces of apparatus generally used with the Electrical Machine exhibiting the effects of Electricity in Motion, such as Nos. 10, 22, 39, 59, 67, 72, 73, 74, 80, 81, 86, 101, 102, 103, in *Electricity*; but with power and brilliancy far exceeding that produced by the largest Electrical machine.

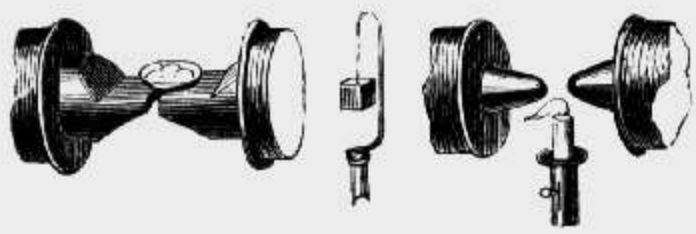
87. Geissler's Tubes for Experiments on the Electric Light; these tubes exhibit some of the most remarkable and beautiful effects of Electricity, — the stratification of the light; fluorescence of gases; fluorescence of liquids; the spectrum shown by a prism or by Babinet's goniometer; the current through a Torricellian vacuum; the rotation of the luminous arch round a magnet. The prices of these tubes range from 4.00 to..... ..... 6.00

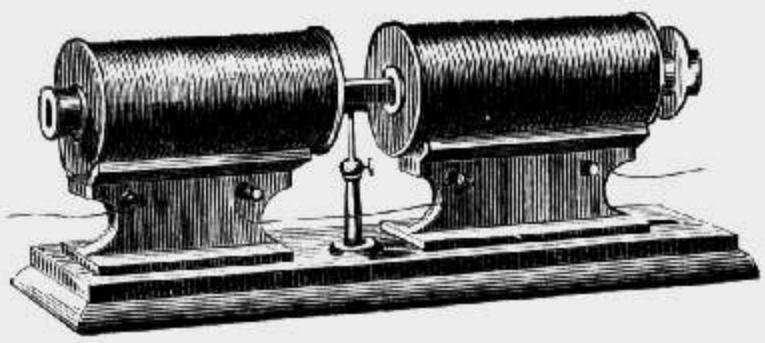
88. Wheatstone's Rheostat; for regulating an electro current to obtain any required force; the instrument consists of a wooden and a brass cylinder, supported on a frame and basement; the cylinder (B) has a spiral groove, in which the turns of a copper conducting wire are laid, and the current passes through the length of the wire upon the *wooden* cylinder; this may be increased or diminished in length at pleasure, ... 25.00

89. Apparatus for Foucault's Experiments of a Revolving Disc between the Poles of an Electro Magnet; a powerful electro-magnet is supported upon a basement; two pieces of soft iron are attached to the poles of the magnet, so that they concentrate, upon the two faces of a metallic disc, their magnetism of induction; a disc of copper receives, by means of pulleys, a rapid revolution; if abandoned to itself this rotation will continue for a long time, but if a current from a battery of two or three cells of Bunsen's or Grove's is passed through the wire the disc is almost immediately stopped; but if against this resistance the disc is forced to revolve, the expense of force is converted into *heat*, and the temperature of the disc is rapidly raised, 18.00 and 25.00



No. 90





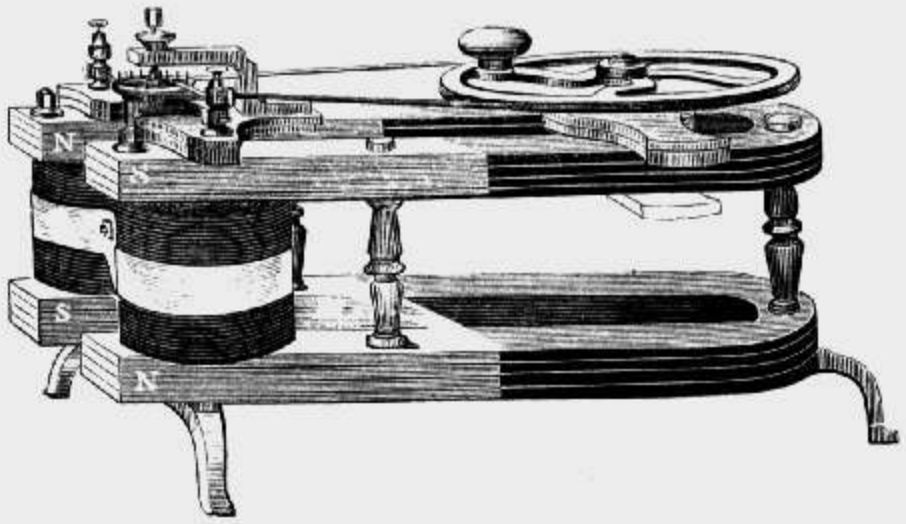
No. 91

NUMBER. PRICE.

90. Arago's Apparatus; for showing the effects upon a magnetic needle of a revolving disc of metal; the instrument is composed of a metallic disc which revolves upon a vertical axis, upon the axis is a pulley driven by a large pulley with a winch; above the disc is a plate of glass, to which is secured a point carrying a magnetic needle; discs of copper and of lead which cause a deviation of the needle as four to one, and one of glass which causes no deviation, 18.00 and $25.00

91. Faraday's Apparatus for Diamagnetism; basement of mahogany; two large helices of insulated copper wire, with hollow cylinders of annealed iron; each helix has a brass tube enclosing a Nicol's prism, to one of which is attached a graduated circle; an adjustable support for crystals, &c.; stand for revolving cube; two pairs of soft iron polar pieces, which fit the iron cylinders. With this apparatus can be performed a great variety of most interesting experiments, viz., Faraday's magnetic rotating polarization of light; the polarization of liquids and solids; the experiments of Plücher upon the magnetism and diamagnetism of liquids and crystals; Bancalary's experiments upon the magnetism of flame; detonation produced by breaking of a current between the poles; the arresting instantly the rotation of a cube of copper, &c., 75.00 and 125.00

92. Commutator or Pole Changer; a convenient arrangement to use with Nos. 82 and 91, or other instruments; by a movement of a lever the current of a battery may be reversed or broken,..... 7.50



No. 94.

NUMBER.		PRICE
93.	Magneto-Electric Machine; five eighteen-inch U magnets and large compound wire armatures, revolving opposite their poles; substantially mounted, brass geared wheels, mahogany basement,	$40.00
94.	Magneto-Electric Machine, of Improved Construction; two large compound magnets, between which revolve armatures surrounded by coils of insulated copper wire; the instrument is arranged for giving shocks or for decomposing water,	45.00
95.	Magneto-Electric Machine; of smaller sizes, 25.00 and	35.00
96.	Lever Beam Axial Engine, 10.00 and	15.00
97.	Vibrating Armature Engine, with Bell,	12.00
98.	Page's Horizontal Revolving Bell Engine,	10.00
99.	Page's Electro-Magnetic Engine; two large helices of insulated wire, within which oscillate cylinders of soft iron attached to a working-beam, to which is also attached an arm to a balance wheel,	18.00
100.	Du Moncel's Electro Motor; with oscillating helix,	30.00
101.	Froment's Electro Motor; the armatures are placed upon the periphery of a large wheel, and are attracted by electro-magnets placed radially to the axis,	40.00
102.	Faraday's Apparatus for the Rotation of a Magnet in Mercury; with platinum counterpoise,	15.00
103.	Apparatus for showing the Incandescence of Carbon and the Fusion of Metals,	16.00
104.	Melloni's Thermo-Electric Battery, or Thermo Multiplier; consisting of antimony and bismuth bars, mounted in mahogany case on brass stand,	25.00
105.	Insulated Copper Wire; 1-16 inch in diameter, per lb.,	1.00
106.	Copper Wire for Battery Current, &c,; cotton covered, per lb.,	1.00
107.	Copper Wire; fine, cotton covered, per lb.,	1.50
108.	Copper Wire; fine, silk covered, per lb., from 2.50 to	4.50
109.	Copper Wire; insulated by gutta percha, per foot,	.06
110.	Connecting Screws for Wires,	.25
111.	Dutch Gold Leaf, for Combustion; per book,	.10

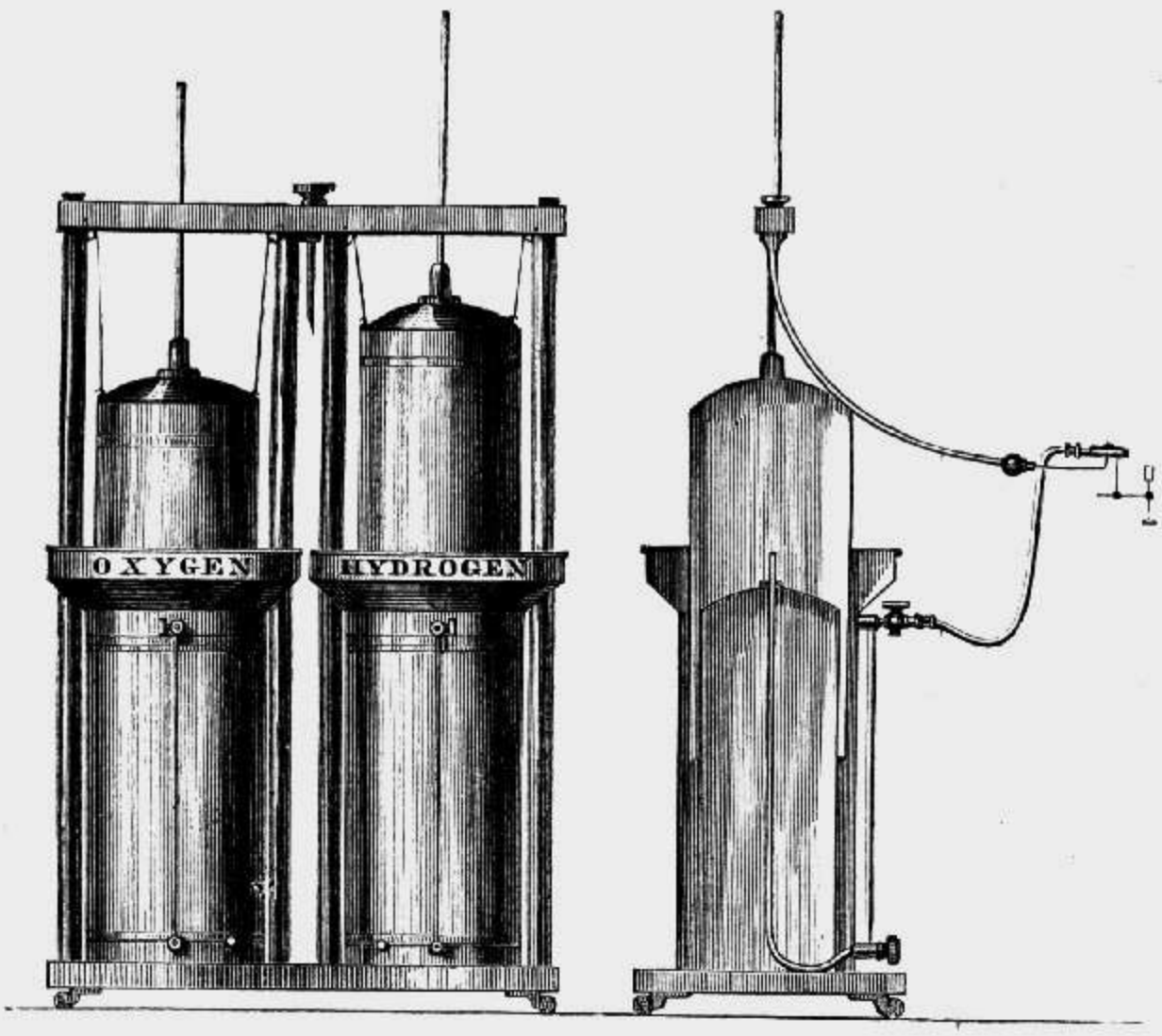
MATHEMATICS.

NUMBER.		PRICE.
1.	Cases of Instruments; polished rosewood box, with set of German silver instruments, from 8.00 to	$22.00
2.	Cases of Instruments; polished wood box and set of brass instruments, 2.50 to	8.00
3.	Ivory Scale; 6 inches,	.75
4.	Ivory Scale; 6 inches, finely graduated,	3.00
5.	Gunter's Scale; 24 inches, boxwood,	.75
6.	Boxwood Triangular Scale; 12 inches,	1.50
7.	Steel U. S. Standard Rule; divided to 8, 10, 12, 14, 16, 24, 28, 32, 48, 50, 64, and 100 parts to the inch; six inches, 75 cents; 12 inches,	1.50
8.	French T Square; of pear-tree, 18 inches,	.75
9.	French T Square and Bevel,	1.50
10.	Parallel Rules; ebony, with brass mountings, 50 cents and	1.00
11.	Proportional Dividers,	2.00
12.	Dividers; brass and German silver screw joints, 37 cents to	1.00
13.	Protractors; semicircle, brass and German silver, 50 cents to	1.00
14.	Protractors; transparent horn,	.50
15.	Tape Measures; of linen, leather case, superior quality; 50 feet, 2.50; 100 feet,	3.50
16.	Tape Measures; brass case, for pocket, with spring; 3 feet,	.75
17.	Tape Measures; German silver, with spring and stop, for pocket; 3 feet, 1.00; 6 feet,	1.25

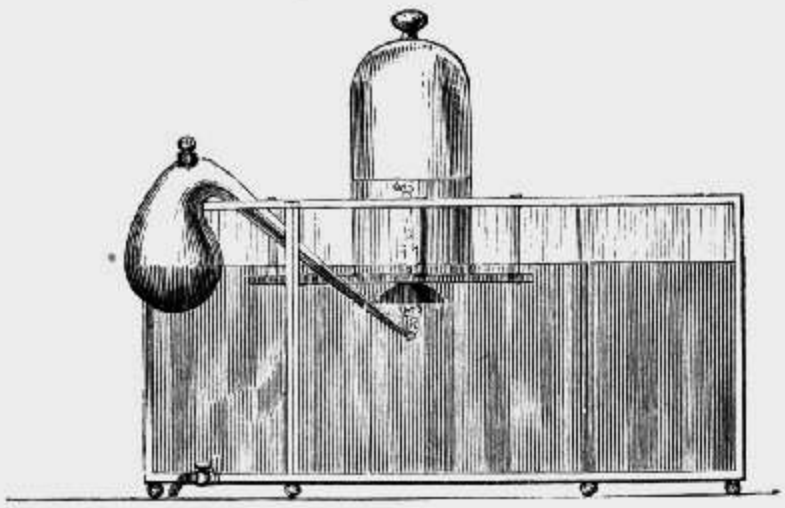
SURVEYING.

1.	Surveying Compass; needle 4 inches, plate 15 inches, ground glass levels; very superior work; in box, with tripod,	31.00
2.	Surveying Compass; needle 5 inches, plate 16 inches; ground glass levels; superior work and finish; accurate and reliable, with tripod,	36.00
3.	Surveying Compass; needle 6 inches, plate 18 inches; ground glass levels; with nonius and tripod,	45.00
4.	Theodolites, or Transit Instruments; of most approved construction and best workmanship; made by Troughton & Simms, London, or J. H. Temple, Boston, 175.00 and	225.00
5.	Levelling Instruments; made by J. H. Temple; thoroughly made and reliable; 16 inch telescope, 150.00; 19 inch telescope,	175.00
6.	Surveying Chains; 2 poles, 50 links, 1.50 and	2.00
7.	Surveying Chains; 4 poles, 100 links,	4.12
8.	Surveying Pins; of iron, each,	.10
9.	Sextant; Troughton & Simms,	60.00
10.	Quadrant; Troughton & Simms,	15.00

CHEMISTRY.



NUMBER		PRICE
1.	Pair of Copper Gasometers; each bell of 30 gallons' capacity, copper interior cylinders, thus requiring but a small quantity of water, brass tubes with stop cocks, rubber hose with jets, compound blow pipe with adjustable holder and calcium light fixtures, inlet pipes with screws, plugs, (the generators may be attached while in use,) cylindrical weights for pressure; the frame stands on casters, the posts enclose the balance weights; thoroughly made and finished, and neatly painted and lettered, ...	100.00
2.	Pair Copper Gasometers; same arrangement and finish, each bell 15 gallons,.....	60.00
3.	Pair Copper Gasometers; same arrangement and finish, each bell 7 gallons,.....	35.00
4.	Pair Gasometers of Zinc; same arrangements, size, and finish, as No. 2; very durable and more economical, ...	45.00
5.	Pair Gasometers of Zinc; size and finish of No. 3, ...	25.00



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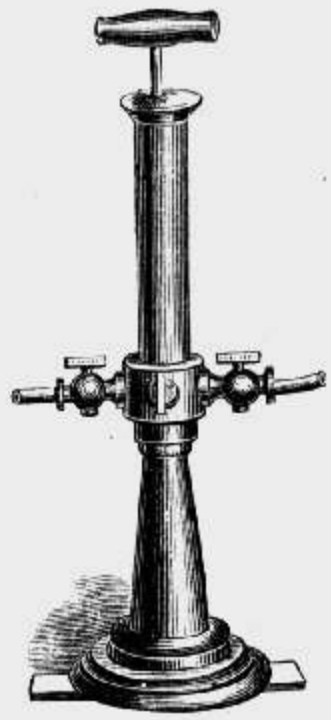


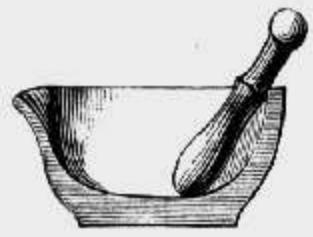
No. 9.

NUMBER.		PRICE.
6.	Pneumatic Cistern; of wood, neatly painted, and lined with tinned copper; 22 by 15 inches, with a well 15 by 8 inches, and 13 inches deep, with stop-cock,	$15.00
7.	Pneumatic Cistern; of copper or wood, made to order — of all sizes and forms, from 5.00 to	50.00
8.	Pneumatic Cistern; of plate glass, by which the operation is visible,	45.00
9.	Condenser or Transferrer; cylinder 7 by 1½ inches; the air or gas is received on one side of the cylinder-base, and expelled on the opposite side through rubber tubes, with stop-cocks and screw sockets; a stop-cock is inserted in the base, so that a direct communication can be made; the cylinder is supported upon a pillar and base, with flanges for the feet,	12.50
10.	Condenser and Transferrer; similar to No. 9, with screw sockets for rubber hose; without side stop-cocks and basement,	8.00
11.	Chemical Furnace; lined with soapstone, with tube-holes and sand-bath; adjusting rings; 12.00 and	15.00
12.	Iron Tube; adapted to furnace, with screws, for decomposing water,	1.00
13.	Chemical Thermometer; with jointed scale, 40° to 600°, very accurate,	4.00
14.	Chemical Thermometer; 450°, plain scale,	2.50
15.	Chemical Thermometer; graduated on the tube to Fahrenheit or Centigrade scale, 2.50 to	4.00
16.	Chemical Spirit Thermometer to —170°,	2.00
17.	Davy's Safety Lamp,	5.00
18.	Gas Bags; of pure vulcanized rubber, spherical, with socket and stop-cock, ten to eighteen inches diameter, 3.00 to	7.00
19.	Gas Bags; square form, with socket and stop-cock, 7.00 to	12.00
20.	Lead Tube; with screw connections, four feet,	1.50
21.	Vulcanized Rubber Tube or Hose; with screws; four feet,	2.00
22.	Hydrogen Balloons; of goldbeater's skin, 12 inch, 1.50; 15 inch, 2.00; 18 inch, 3.00; 24 inch, 4.00; with net, 2.00 extra.	


No. 23.

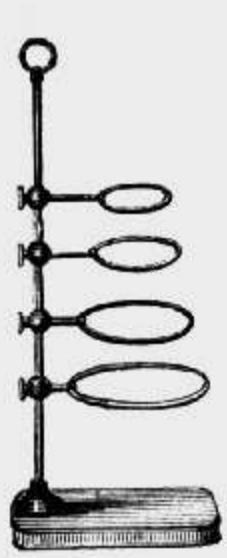

No. 24.


No. 38.


No. 40.

NUMBER.

23. Malleable Iron Retort and Tube; pint, 2.00; two pints, 2.50; three pints, ... $3.00
24. Copper Retort or Flask; screw cap, for generating oxygen with spirit lamp, may be attached to gasometers by gallows screw, quart,..... 3.50
25. Porcelain Retort, for oxygen, 2.00 and 3.00
26. Cast Iron Mercury Cisterns,..... 1.00
27. Platinum Spatula; 1.50, 2.00, and 2.50
28. Steel Spatula; 25 cents and ..... .50
29. Copper Pendent Spoon and Rod, ... .25
30. Platinum Pendent Spoon and Rod..... 1.00
31. Pendent Sockets for tapers, &c., 25 cents and ..... .50
32. Wedgewood Evaporating Dishes; 15 cents to ..... .35
33. Glass Evaporating Dishes; 15 cents to..... .35
34. Porcelain Evaporating Dishes; in nests of six, ... 1.00
35. Porcelain Evaporating Dishes; 65 cents to 1.00
36. Platinum Forceps, 2.00 and 3.00
37. Set three Wire Gauze, for experiments with flame, ... .50
38. Hessian Crucibles; in nests of five,..... .20
39. Glass Mortar and Pestle; 50 cents, 75 cents, and..... 1.00
40. Porcelain Mortar and Pestle; 1.00, 1.50, and 2.00
41. Iron Mortar and Pestle; 1.25, 1.50, and 1.75
42. Agate Mortar and Pestle; 3.00 to..... 6.00
43. Alcohol Blast Lamp; of copper, 2.00 and 3.00
44. Glass and Rubber Syringes; for washing filters; 50 cents to 1 50
45. Glass Graduated Jar; two hundred cubic inches, ... 2.00
46. Graduated Tubes; for specific gravity, ... .50
47. Hydrogen Bubble Pipe, of brass,..... .50
48. Cryophorus; large size, very superior, ... 2.00
49. Sheet Rubber; piece, for square foot,..... .25
50. Sheet Rubber vulcanized; elastic and strong, 50 cents and ..... .75
51. Dissolved Rubber, in tin boxes, 37 cents and ..... .50
52. Rubber Tubing; very superior, per foot,..... .25
53. Gallows Screws, Dr Hare's, (See *Pneumatics*,) 1.25
54. Cork Borers; set of six, ... 2.50
55. Cork Borers; set of three, ... 1.50
56. Round and Flat Rasps, for corks, each, 50 ..... .75



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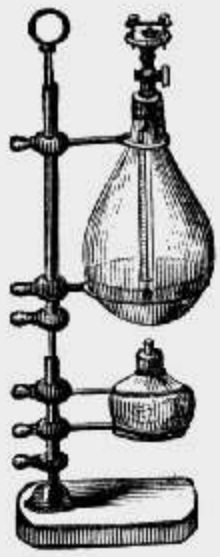
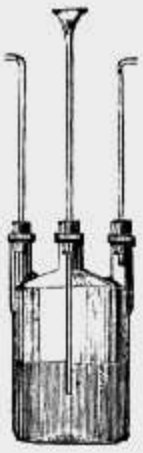


No. 58.

No. 59.

No. 63.

NUMBER.		PRICE.
57.	Lamp Stand; with four bows and binding screws,	$2.00
58.	Lamp stands; with four bows on tubes, with binding screws, which can be readily elevated and depressed, 3.00 and	3.50
59.	Hydrogen Gas Generator; with gas jet, platinum sponge, and long jet for detonating gas, two quarts capacity, 4.00; four quarts,	6.00
60.	Hydrogen Generator; in frame, with basement and fixtures, eight quarts, 8.00; twelve quarts,	12.00
61.	Improved Hydrogen Generator; a cylindrical vessel of copper, of 16 gallons capacity, with handles and cover; an interior inverted bell of copper, with overflow tube, copper zinc holder and stop-cock; the generator will supply a constant flow of hydrogen sufficient for the oxy-hydrogen light for two hours,	20.00
62.	Purifier; a copper cylinder, with screw cap and stop-cock; a diaphragm punctured with holes is placed near the bottom; in use it is screwed upon the stop-cock of the generator and filled with pieces of lime, which purifies and desiccates the gas as it flows through,	5.50
63.	Prof. Rogers's Apparatus for the Combustion of Atmospheric Air in Hydrogen and Carburetted Hydrogen; a glass cylinder is supported upon a stand; its upper end is closed with a cork, through which passes a tube with hose for a supply of hydrogen gas; a cork closes the lower end, through which is inserted a jet pipe for air with rubber tube; an overflow pipe for the hydrogen; the jet of air can be lighted in its *atmosphere* of hydrogen within the cylinder; the hydrogen flowing out of the escape pipe can also be lighted in the air; a sliding rod passes through the upper cork, with a coil of platinum wire,	4.50
64.	Sand Bath for Lamp Stand, 75 and	1.00
65.	Chemical Tongs; 50 cents, 1.00, and	1.50
66.	Crucible Tongs,	1.25
67.	Iron Ladles, 25 cents and	1.00
68.	Brass Argand Lamp; on adjusting stand,	7.00
69.	Sefstroem's Retort Holder; wood clamps, mounted on iron stand,	3.00
70.	Nipper Tube Holder; wood screw clamps with cork jaws,	2.00
71.	Elevating stands; with table, tripod, and bughorn,	1.50



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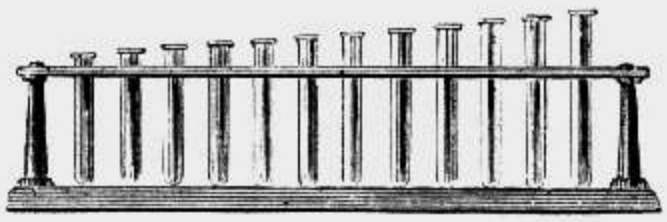


No. 80.

No. 83.

NUMBER.		PRICE.
72.	Cannon, for firing with potassium, and an icicle,	$4.00
73.	Copper Alcohol Lamp, with five wicks,	1.50
74.	Spirit lamp; with ground cap,	1.00
75.	Aphlogistic Lamp; with platinum coil, 1.00 and	2.00
76.	Bunsen's Gas Jets; single tube and stand,	1.00
77.	Bunsen's Gas Jets; composed of four jets and stand,	3.00
78.	Plain Mouth Blowpipe; of brass,	.50
79.	Blowpipe; with condensing bulb, 1.50; with ivory mouth-piece,	2.50
80.	Test Tubes; with mahogany stands; 12 tubes,	2.00
81.	Heavy Silver Capsule and stand for the Spheroidal state of Water; the capsule is to be raised to a white heat, and filled with water, which explodes when the temperature is reduced, 7.00 to	12.00
82.	Brass Capsule and Stand; to be used over a spirit lamp,	2.50
83.	Volta's Eudiometer, graduated,	1.50
84.	Ure's Eudiometer, graduated,	2.50
85.	Marsh's Arsenic Apparatus,	2.00
86.	Porcelain Crucibles; glazed, with covers, 17 cents to	.50
87.	German Filtering Paper, per quire,	.50
88.	Mouth-Piece for Inhaling Gas, 75 cents and	1.00
89.	Dropping Tube; with rubber air bag,	1.00
90.	Metal covered Rings, for supporting glass flasks, in nests of six,	1.50
91.	Cork Knives, large and small, 25 and	.75
92.	Flat or Round Pliers and Cutting Nippers, 50 cents and	1.00
93.	Charcoal Borers; cast steel, with handles, 75 cents and	1.25
94.	Cork rasps, round and flat, with handle, 33 cents to	.75
95.	Steel spatulas or palette knives; 50 cents to	1.00
96.	Mercury trough of cast iron, with cistern for filling tubes; movable clamp tube holder, with adjustable ring,	6.00
97.	Mercury troughs of porcelain, holding from six to twelve lbs.; 1.25 to	2.75
98.	Steel-faced square anvils for the table; 2.75 and	5.50
99.	Mineralogical hammers of cast steel, with hard wood handles, the edge parallel or at right angles with the handle; 1.50 to	2.50
100.	Vise, with jaws 3 1-2 inches wide, opening six inches in parallel motion, strong and serviceable,	6.50

Chemical Glass Ware.

NUMBER.		PRICE.
101.	Plain Bell Receivers, (See *Pneumatics*, No. 15,) 30 cents to	$3.00
102.	Stoppered Bell Receivers, (See *Pneumatics*, No. 16,) 40 cents to	3.50
103.	Tall Open Top Receivers, (See *Pneumatics*, No. 13,) 1.50 to	4.00
104.	Bell Receivers, (Transfer Jars;) with brass caps, and graduated to cubic inches; 1 quart, 3.00; 2 quarts, 3.75; 4 quarts,	4.25
105.	Bolt Heads, or Matrasses; half pint, 33 cents; pint, 42 cents; quart, 50 cents; two quart,	.75
106.	Funnels; minim, 15 cents; gill, 17 cents; half pint, 25 cents; pint, 35 cents; quart,	.42
107.	Alembics; for distillation; pint, 1.75; quart,	2.00
108.	Air Thermometer Bulb, and Tube; 25 cents, and	.50
109.	Graduated Ounce Measure; 2 oz., 62; 4 oz., 65; 8 oz., 1.00; 16 oz.,	1.50
110.	Graduated Ten Cubic Inch Measure,	1.25
111.	Stirring Rods; set of six, 37 to	.75
112.	Adapters; straight and bent,	.25
113.	Safety Tubes, to use with Woulfe's bottles,	.75
114.	Safety Tubes; bent, with bulbs,	.75
115.	Sulphuretted Hydrogen Generator; with glass stop-cock,	6.00
116.	Pipette or Dropping Tube; 25 cents and	.35
117.	Bulb and Tube; for condensation of mixed liquids,	.75
118.	Two Bulbs and Tube, Brand's; for condensation,	.50
119.	Graduated 60 Drop Tube, on foot,	.75
120.	Glass Chemical Tubes; per lb.,	.50
121.	Glass Barometer Tubes; small and large, per lb.,	1.00
122.	Rupert's Drops; unannealed glass, per dozen, 50 and	.75
123.	Nooth's Apparatus for Impregnating Water with Carbonic Acid,	20.00

Bohemian Hard Glass Without Lead.

124.	Retorts; plain, 2 oz., 25 cents; 4 oz., 30 cents; half pint, 35 cents; pint, 40 cents; quart,	.50
125.	Retorts; tubulated, 3 oz., 30 cents; 4 oz., 30 cents; half pint, 35; pint, 40 cents; quart,	.60
126.	Flasks with rim necks for corks, uniformly thin throughout; 4 oz., 20 cents; half pint, 25 cents; pint, 40 cents; quart,	.50
127.	Digesting Flasks; with flat bottoms and rim neck; uniformly thin throughout; 2 oz., 20 cents; 4 oz., 20; half pint, 30 cents; pint, 40 cents; quart,	.50
128.	Woulfe's Bottles; with three necks; half pint, 56 cents; pints, 75 cents; quarts,	1.00
129.	Globe Receivers; tubulated; 4 oz., 30 cents; half pint, 35 cents; pint, 45; quart,	.50
130.	Beaker Glasses, Berzelius's; of latest form; tall, with spreading rim; in nests of eight, from 6 oz. to 3 quarts,	3.00
131.	Beaker Glasses, Berzelius's; with lip, in nest of six, from 4 oz., to 1 quart,	1.50
132.	Beaker Glasses; singly, 4 oz., 15 cents; 8 oz., 20 cents; 12 oz., 25 cents; pint, 35 cents; 1½ pints, 40 cents; quart,	.50
133.	Test Tubes; with rim and lip, carefully made; per dozen,	.75
134.	Test Glasses; of wine-glass shape with lip; 1 to 3 oz., per doz., 1.00 to	1.50
135.	Tubing for Analysis; thin and quill, per lb.,	1.00

Chemical Balance.

NUMBER. PRICE.

136. Analytical Balance; the beam is twelve inches in length; the central portion is cut from a solid piece of brass, in which is placed the knife-edge, firmly secured by adjusting screws; the arms are formed by thin, hollow, conical tubes (the best form to unite inflexibility with lightness); the knife-edge rests upon an agate plane, supported upon a steel rod, which passes through the pillar and is raised by an eccentric. A central support, with conical guides, receives the beam when it is lowered and prevents its displacement; a needle eleven inches long, attached to the beam, traverses over a scale graduated upon the pedestal; above the beam is a needle with a screw thread and weight to adjust the centre of gravity, and a small flag to adjust the balance; gilded scale-pans suspended by platinum wires. The balance is enclosed in a beautiful mahogany case, with marble platform, and sliding glass doors. The horizontal position of the beam is effected by levelling screws, a plumb line attached behind the pillar passes through a ring with marks at right angles. The balance will carry 200 grammes, and turn with ½ millegramme. This instrument is constructed with great care and finish, and combines accuracy and precision with strength and durability, ... $65.00

137. Set of accurate gramme weights of 100 grammes, from 50 grammes down to 1 gramme, in brass cylindrical gilded weights, and down to a millegramme of platinum, enclosed in mahogany case, with forceps and ivory fork, ... 12.50

138. Set of weights, 600 grammes, contains from 300 grammes down to 1 gramme, in gilded cylindrical weights, and down to 0.001 in platinum, with forceps and ivory fork, enclosed in a mahogany case..... 18.00

139. Set of accurate grain weights of 2000 grains, from 1000 down to 10 grains, in gilded cylindrical brass weights, and from 5 grains down to 0.01 grain of platinum, enclosed in mahogany case with forceps and ivory fork, ... 12.50

Chemicals.

140. Sets of chemicals, prepared and selected by a practical chemist, adapted to a course of experiments, put up in strong stoppered bottles and labelled, carefully packed in box. The set will be particularly adapted to any manual of chemistry if desired. Price according to quantity and variety, 15.00 to 40.00

141. Mercury, of good quality, variable, 75 cents to 1.00

142. Mercury, redistilled and pure, variable, 1.00 to 1.25

143. Chlorate of potassa for making oxygen; per lb., 75 cents to 1.00

144. Peroxide of manganese; per lb., ... .20

145. Granulated zinc; per lb., ... .25

146. Sulphate of copper; per lb., ... .20

Sulphuric, nitric, and other acids and chemicals, including rare minerals and metals, furnished at market prices.

NOTE.—Acids, corrosive articles, &c., will not be packed with apparatus, but always in a separate box, and marked "Acids."

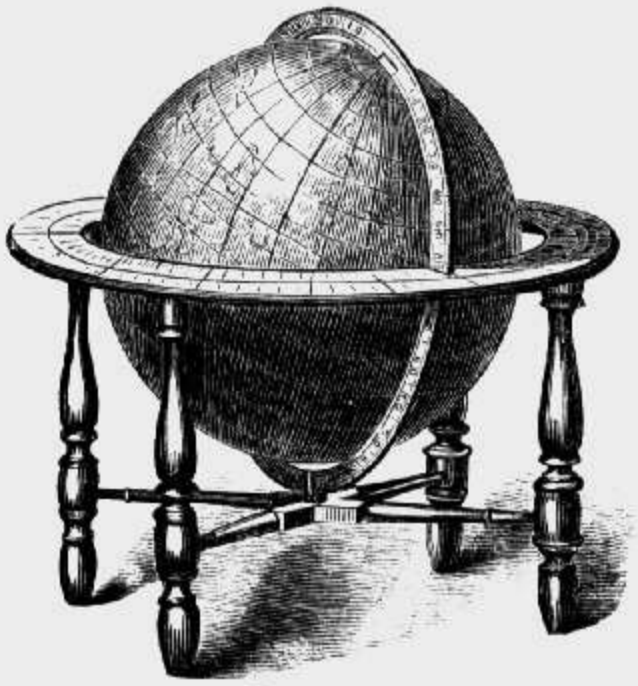
ASTRONOMY.

Nos. 1, 2.

Loring's Celestial and Terrestrial Globes. These globes are considered the most accurate and reliable of any now made; the engravings are corrected to the most recent discoveries and changes; the mechanical construction is superior.

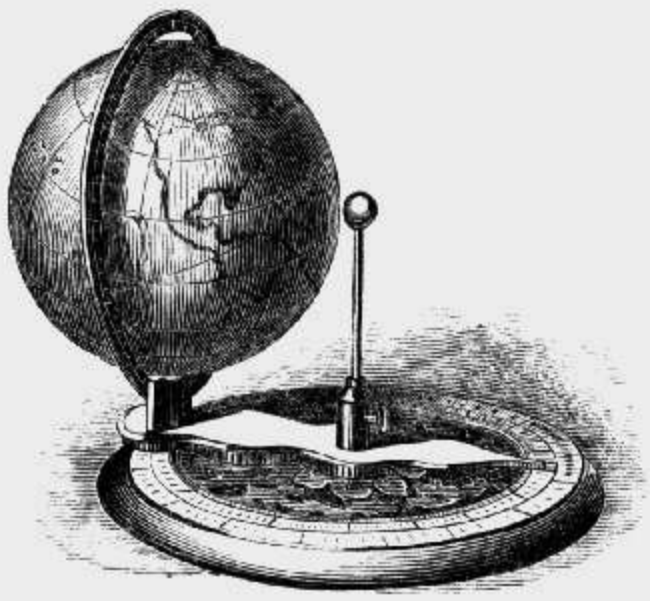
NUMBER.		PRICE.
1.	Celestial and Terrestrial Globes; 18 inches diameter, (from Smith's London engravings,) mounted upon bronzed pedestals, with casters,	$100.00
2.	Celestial and Terrestrial Globes; 12 inches diameter; on bronzed pedestal stands with casters; this style of mounting has the advantage of great stability, convenience, and beauty of design; per pair,	45.00
3.	Improved High-mounted Globes; 12 inches diameter; stands 48 inches high, on iron legs, neatly bronzed; the pedestal is of mahogany, and receives the shaft on which the globe is mounted. This arrangement admits of a horizontal rotary motion to the globe,	45.00
4.	Globes; 12 inches diameter, on mahogany frame stands; per pair	25.00
5.	Globes; 10 inches diameter, on mahogany frame stands; per pair,	20.00
6.	Globes; 10 inches diameter, mounted on mahogany semi-stands; pair,	12.00
7.	Globes; 6 inches diameter, on mahogany frame stands; per pair,	10.00
8.	Globes; 6 inches diameter, on semi-stands; per pair,	5.00

Either of the above Celestial or Terrestrial Globes may be had separately.



Nos. 4, 5.

No. 6.



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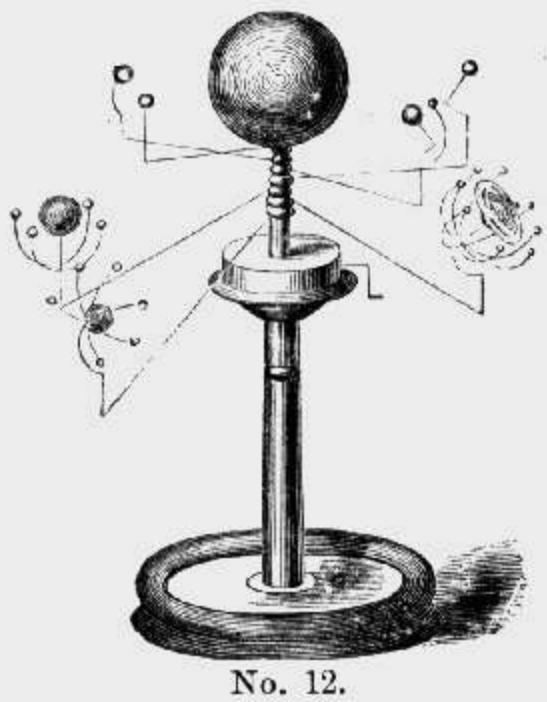

No. 12.

NUMBER.		PRICE.
9.	Joslin's Solar Telluric Globe,	$7.00
10.	Improved Spring Orrery; mounted on brass pillar and basement; gilded sun and planets; new and improved brass frame and wheels; motion given to Earth's and Jupiter's Moons,	45.00
11.	Orrery; with brass pillar and base; crank motion, new and improved wheel-work, by which a uniform motion is obtained; brass tubes; bronzed planets,	15.00
12.	Orrery; similar to No. 11, with mahogany pillar and base; finely finished,	10.00
13.	Improved Season's Machine, giving the Motions of the Earth around the Sun, the Inclination and Parallelism of the Earth's Axis, the Causes of the Seasons, the Revolution of the Moon around the Earth, the Moon's Nodes, the Revolution of the Sun and Earth on their Axes; 5 inch sun, 3 inch terrestrial globe for the earth,	7.00
14.	Season's Machine; similar to No. 13, with brass pillar and basement,	10.00
15.	Movable Planisphere; showing the position of the heavens at any given time; 16 inches square; plain, 2.00; colored	2.50
16.	Illustration of the Precession of the Equinoxes; (See *Gyrascope*, No. 41, MECHANICS,)	15.00

METEOROLOGY.

NUMBER.		PRICE.
1.	Standard Barometer; Smithsonian, mounted in iron and brass tubes; mercury cistern of glass; very accurate, 25.00 and	$35.00
2.	Standard Barometer, Adie's Liverpool; with table of corrections by the Astronomer of the Royal Observatory; in use in the United States Navy,	35.00
3.	Pediment Barometer; with ivory scales; rack-work vernier; thermometer on the front, with polished rosewood frame, 15.00 and	18.00
4.	Pediment Barometer; silvered scale, vernier, and thermometer; rosewood frame,	12.00
5.	Aneroid Barometer; of metal enclosed in a brass case, six inches diameter, enclosed in morocco case; portable and accurate,	18.00
6.	Mason's Wet and Dry Bulb Hygrometer; on boxwood scale, with glass fountain tube, 4.00 and	6.00
7.	Daniel's Hygrometer; complete in mahogany box,	14.00
8.	Saussure's Hair Hygrometer; with scale,	4.00
9.	Thermometers in Japanned Tin Cases; 6 inch, 70 cents; 8 inch, 75 cents; 10 inch,	1.00
10.	Thermometers in Polished Boxwood Frame; 8 inch, 125; 10 inch,	1.50
11.	Thermometer; superior mounting, for exterior,	3.50
12.	Thermometers; self-registering; boxwood scale for cold, 2.00 and	2.50
13.	Thermometer; self-registering, boxwood scale, for heat,	3.00
14.	Thermometer; self-registering, for heat and cold; boxwood scale with magnet,	5.00
	NOTE.—This instrument is extremely liable to be deranged and injured by transportation, and will not be sent unless expressly ordered.	
15.	Rain Gauge of Brass; conical form, with graduated scale, measuring a slight fall of rain with great accuracy,	7.00
16.	Rain Gauge; japanned, with graduated float,	5.00
17.	Rain Gauge; of copper, with graduated float,	8.00
18.	Rain Gauge; of improved form; copper cylinder with exterior glass tube and graduated scale; square receiving funnel,	10.00
19.	Sun Dials; of brass, silvered, for any latitude, 8,00 and	12.00

TERMS, CASH.

Prices uniform and definite; no deviation from Catalogue prices.
Boxes, packing and shipping, 2½ per cent. on the amount of bill.
Insurance against breakage by transportation, 2½ per cent.
Marine Insurance, at current rates of underwriters.
Sight Drafts on New York or Philadelphia received at par.

SELECTIONS

OF

PHILOSOPHICAL APPARATUS,

COMPILED FROM THE

CATALOGUE.

THE following Sets have been compiled with the view to combine instruments for the illustration of as many and as varied principles as the limits of the amount of each set will permit, to avoid duplications, and as far as possible to represent proportionately each department of Physical Science.

It will be observed that the larger instruments have not been included in any of the sets, nor have many of the most valuable and important, and comparatively expensive, instruments, but only those that are generally required; leaving the purchaser to substitute the larger, and to select from the Catalogue other instruments, as may be desirable.

Where the requirements of institutions would be better subserved by giving greater prominence to particular branches, a more satisfactory selection might be made by taking the separate departments from different sets.

In each department are instruments for interesting and beautiful experiments, which have been excluded from the sets to admit others elucidating different principles.

The Ruhmkorff Induction Coil has rendered the larger Electrical Machines less desirable; the great advantages of the former have already been mentioned in the Catalogue.

The *numbers* correspond with those in the Catalogue.

SET OF APPARATUS No. 1.

Laws of Matter and Mechanics.

2. Lead Hemispheres 75
3. Inertia Apparatus 1.00
4. Capillary Plates 1.00
7. Set of Collision Balls 4.00
33. Mechanical Powers 30.00

Hydrostatics.

3. Set of Equilibrium Tubes. 3.00
5. Pressure of Liquids. 2.00
24. Liquid Cohesion 1.00
37. Set of Water Pumps 12.00

Pneumatics.

8. Lever Air Pump, of Ritchie's improved construction 25.00
12. Glass Bell Receiver 2.00
15. Glass Bell do., quart 75
19. Tall Bell do 2.00
20. Tall Jar for do.. . . . . 1.00
21. Hand and Bladder Glass 75
33. Magdeburg Hemispheres. 5.00
59. Guinea and Feather Tube 5.00
77. Bacchus Illustration 1.50
88. Rubber Bag and Hook 1.25

Heat.

1. Air Thermometer 25
3. Franklin's Pulse Glass 75
7. Pyrometer and Rods 3.50
9. Conductometer and Rods 1.50
20. Fire Syringe and Tinder 1.50
24. Wollaston's Steam Engine. . . . 3.00

Optics.

1. Prism 75
6. Multiplying Lens in Tube 50
10. Convex and Concave Lenses . . . 2.00
14. Convex and Concave Mirrors . . 2.00
75. Compound Microscope 5.00

Electricity.

10. Electrical Machine 25.00
11. Leyden Jar 1.00
23. Spiral Spotted Tube 2.50
27. Discharger 2.00
32. Set of Electrical Bells 3.00
36. Pair of Plates 2.00
40. Dancing Images 50
41. Pith Ball Electrometer 50
49. Electrical Tellurian 1.50
58. Miser's Plate 1.00
65. Powder Bomb. 1.25
104. Head of Hair 75
96. Box of Amalgam 25

Magnetics.

4. Large U Magnet 1.00
8. Needle and Stand 1.00
24. Sulphate of Copper Battery . . . 3.00
37. Powder Cup. 50
60. Model of Telegraph 5.00
61. Heliacal Ring 2.50
70. Double Helices or Shocker . . . 5.00
72. Pair of Handles 1.50
76. Set of Insulated Wires 50

Astronomy.

9. Solar Telluric Globe 7.00
12. Improved Orrery 10.00
15. Movable Planisphere 2.00

MECHANICS	$36.75
HYDROSTATICS.	18.00
PNEUMATICS.	41.25
HEAT.	10.50
OPTICS.	10.25
ELECTRICITY.	41.25
MAGNETICS	20.00
ASTRONOMY	19.00
	$200.00

SET OF APPARATUS No. 2.

Laws of Matter and Mechanics.

2. Lead Hemispheres 75
3. Inertia Apparatus 1.00
4. Capillary Tubes 1.25
7. Set of Collision Balls. 4.00
18. Central and Centrifugal Forces. . 8.00
33. Set of Mechanical Powers Complete. 30.00

Hydrostatics.

2.	Equilibrium Tubes	4.00
5.	Pressure of Liquids	2.00
6.	Archimedes' Principle	3.00
14.	Nicholson's Hydrometer	3.25
17.	Specific Gravity Scales	8.00
22.	Glass Siphon	.50
24.	Liquid Cohesion	1.00
25.	Hydrostatic Bellows	10.00
31.	Tantalus' Cup	1.50
37.	Set of Water Pumps	12.00

Pneumatics.

8.	Lever Air Pump, of Ritchie's improved construction	25.00
10.	Improved Condenser	6.00
15.	Glass Bell Receiver	1.00
17.	Bell Receiver with Cap	3.50
18.	Straight Jar for do.	1.00
19.	Tall Bell Receiver	2.00
20.	Tall Jar for do.	1.00
22.	Hand and Bladder Glass	1.00
32.	Magdeburg Hemispheres	6.00
37.	Revolving Jet	1.25
39.	Bell for Vacuum	1.25
45.	Upward Pressure	5.00
59.	Guinea and Feather Tube	6.00
77.	Bacchus Illustration	1.50
80.	Rubber Hose and Sockets	2.00
84.	Sliding Rod for Receiver	1.75
86.	Air Gun with Balls	1.00
88.	Rubber Bag and Stop-cock	2.00
93.	Condensing Chamber and Stop-cock	3.50
101.	Plate Paradox and Discs	1.00
	Set of three Connecters	1.50
120.	Leather Washers	.25
121.	Prepared Oil	.25

Acoustics.

3.	Iron Screw Press	5.00
5.	Two Glass Plates	2.25
6.	Brass Plate for Vibration	3.00
8.	Hopkins's Apparatus	6.00
10.	Violoncello Bow	2.00

Heat.

1.	Air Thermometer	.50
4.	Mounted Spirit Boiler	2.00
6.	Pair of Reflectors	6.00
7.	Pyrometer	3.50
9.	Conductometer	1.50
13.	Compound Bar	1.25
19.	Non conduction of Liquids	3.00
20.	Fire Syringe	1.50
22.	Brass Eolipile	1.50
24.	Wollaston's Illustration of the Steam Engine	3.00
	Spirit Lamp	1.00

Optics.

1.	Prism	1.25
6.	Multiplying Glass	.50
10.	Set of four Lenses	4.00
12.	Set of Eye Models	12.00
13.	Convex and Concave Mirrors	2.50
75.	Microscope	7.00

Electricity.

9.	Electrical Machine	30.00
13.	Movable Coatings Jar	3.50
15.	Diamond Jar	3.00
17.	Sportsman and Birds	.75
20.	Improved set of Jars	4.50
22.	Spiral Spotted Tube	2.50
24.	Ether Spoon	.75
28.	Jointed Discharger	3.50
32.	Electrical Bells	3.00
36.	Dancing Image Plates	2.00
40.	Figures for do.	.50
41.	Pith Ball Electrometer	.50
47.	Electrical Flier	.50
54.	Insulating Stool	4.50
65.	Powder Bomb	1.25
96.	Amalgam	.25
101.	Gassiot's Cascade	1.50
104.	Head of Hair	.75

Magnetics.

1.	Bar Magnet	1.00
4.	Large U Magnet	1.50
6.	Wheel Armature	.50
8.	Needle and Stand	1.00
25.	Smee's Battery	2.25
38.	Pistol	3.00
39.	De la Rive's Ring	1.50
53.	Electro Magnet	1.00
55.	Revolving Magnet	5.00
60.	Telegraph Model	5.00
61.	Heliacal Ring	3.50
70.	Double Helices for Shocks	5.00
72.	Handles	1.50
76.	Insulated Wires	.50

Astronomy.

9.	Solar Telluric Globe	7.00
12.	Improved Orrery	10.00
15.	Planisphere	2.50

MECHANICS	$45.00
HYDROSTATICS	45.25
PNEUMATICS	74.50
ACOUSTICS	18.25
HEAT	24.75
OPTICS	27.25
ELECTRICITY	63.25
MAGNETICS	32.25
ASTRONOMY	19.50
	$350.00

SET OF APPARATUS No. 3.

Laws of Matter and Mechanics.

1. Glass Adhesion Plates 1.00
2. Lead Hemispheres 75
3. Inertia Apparatus 1.00
4. Capillary Tubes 1.25
7. Collision Balls 4.00
14. Centre of Gravity 7.00
19. Central and Centrifugal Forces . 10.00
34. Mechanical Powers 40.00
38. Gyrascope 6.00

Hydrostatics.

2. Equilibrium Tubes 4.00
5. Pressure of Liquids 2.00
12. Hydrometer 2.00
13. Hydrometer Jar, graduated . . . 1.25
17. Specific Gravity Scales 8.00
22. Glass Siphon 50
24. Liquid Cohesion 1.00
25. Hydrostatic Bellows 10.00
31. Tantalus Cup 1.50
37. Set of Water Pumps 12.00

Pneumatics.

7. Ritchie's Improved Air Pump . . 40.00
10. Condenser 6.00
12. Glass Bell Receiver 2.00
15. Bell Receiver 1.00
17. Bell Receiver with Cap 3.50
18. Straight Jar for do. 1.00
19. Tall Bell 2.00
20. Jar for do. 1.00
22. Hand and Bladder Glass 1.00
32. Magdeburg Hemispheres 6.00
37. Revolving Jet 1.25
39. Bell for Vacuum 1.25
44. Upward Pressure 6.00
53. Bolt Head 1.50
55. Barometer Apparatus 3.50
59. Guinea and Feather Tube 6.00
69. Weighing Air Globe 3.50
80. Rubber Hose 2.00
85. Sliding Rod 1.25
86. Air Gun and Balls 1.00
88. Rubber Bag and Stop-cock 2.00
93. Condensing Chamber 2.50
Three Couplers 1.50
Washers and Prepared Oil 75

Acoustics.

3. Iron Screw Press 5.00
5. Three Glass Plates 3.50
7. Brass Plate 3.00
9. Hopkins's Tube 6.50
10. Violoncello Bow 2.00
13. Diapason 6.00
17. Tube for Sonorous Flame 50
20. Interference of Sounds 3.00
31. Organ Pipe 3.00

Heat.

1. Air Thermometer 50
3. Pulse Glass 2.00
6. Reflectors 6.00
7. Pyrometer 3.50
9. Conductometer 2.00
12. Ring and Ball 2.00
19. Non-conduction of Liquids . . . 1.50
20. Fire Syringe and Tinder 1.50
22. Brass Eolipile 1.50
24. Wollaston's Steam Engine . . . 3.00
13. Compound Bar 75

Optics.

1. Prism 1.25
6. Multiplying Lens in Tube 50
10. Set of Four Lenses 4.00
12. Set of Eye Models 12.00
13. Convex and Concave Mirrors . . 2.50
19. Kaleidoscope 1.50
20. Revolving Disc 6.00
22. Set of Discs 3.50
47. Plates for Newton's Rings . . . 1.00
48. Press for do. 1.50
75. Compound Microscope 7.00

Electricity.

8. Electrical Machine 50 00
13. Movable Coatings Jar 3.00
15. Diamond Jar 3.00
17. Sportsman and Birds 75
20. Improved Set of Jars 4.50
22. Spiral Tube 3.50
24. Ether Spoon 75
28. Jointed Discharger 3.50
32. Electrical Bells 3.00
36. Image Plates 2.00
58. Miser's Plate 1.00
40. Images 50
41. Electrometer 50
47. Electrical Flier 75
54. Insulating Stool 6.00
65. Powder Bomb 1.25
71. Sliding Directing Rod 2.00
76. Thunder House 6.00
96. Amalgam 50
101. Gassiot's Cascade 1.50

Magnetics.

1. Bar Magnet 1.00
4. Large U Magnet 1.50
6. Wheel Armature 50
7. Star Armature 50
8. Needle and Stand 1.00
19. Breaking Magnets 50
23. Sulphate of Copper Battery . . . 6.00
33. Contracting Helix 3.50
30. De la Rives Ring. 1.50

49. Galvanometer	3.00
53. Electro Magnet	1.50
55. Revolving Magnet	1.00
60. Telegraph Model	5.00
61. Heliacal Ring	3.50
70. Shocker	5.00
73. Pair of Handles	2.00
76. Insulated Wires	.50
81. Terrestrial Helix	1.50

Chemistry.

14. Chemical Thermometer	2.50
18. Gas Bag and Stop-cock	4.50
25. Porcelain Retort	2.00
29. Pendent Spoon	.25
34. Set of Evaporating Dishes	1.00
37. Set of Wire Gauze	.50
38. Set of Hessian Crucibles	.20
40. Mortar and Pestle	1.00
47. Bubble Pipe	.50
49. Sheet Rubber	.30
55. Cork Borers	1.50
57. Lamp Stand	2.00
59. Hydrogen Generator	4.00
74. Spirit Lamp	1.00
78. Blow Pipe	.50
106. Funnel	.25
114. Safety Tube	.75
116. Pipette	.25
124. Three Retorts	1.00
126. Three Flasks	1.00
128. Woulfe's Bottle	.55
120. Glass Tubing, assorted	1.00
129. Globe Receiver	.45
133. Test Tubes	.75

Astronomy.

12. Improved Orrery	10.00
13. Seasons Machine	7.00
15. Movable Planisphere	2.00

Meteorology.

4. Barometer and Thermometer	12.00

LAWS OF MATTER	71.00
HYDROSTATICS	42.25
PNEUMATICS	97.50
ACOUSTICS	32.50
HEAT	24.25
OPTICS	40.75
ELECTRICITY	94.00
MAGNETICS	39.00
CHEMISTRY	27.75
ASTRONOMY	19.00
METEOROLOGY	12.00
	$500.00

SET OF APPARATUS No. 4.

Laws of Matter and Mechanics.

Selection of Set No. 3	71.00
30. Illustration of the Pendulum	6.00
	77.00

Hydrostatics.

Selection of Set No. 3	42.25

Pneumatics.

Selection of set No. 3	97.50

Theory of Undulations.

2. Improved Wave Instrument	35.00

Acoustics.

Selection of Set No. 3	32.50
11. Nodes of a Bell	7.00
	39.50

Heat.

Selection of Set No. 3	24.25
16. Tall Mercury Cistern	10.00
27. Ritchie's Sectional Steam Engine	35.00
	69.25

Optics.

Selection of Set No. 3	40.75
25. Stereoscope	4.00
Assortment of Pictures	12.00
53. Snell's Accidental Colors	5.50
	62.25

Electricity.

Selection of Set No. 3	94.00
25. Insulated Conductor	12.00
87. Coulomb's Sphere	7.00
88. Test Needle	.50
	113.50

Magnetics.

Selection of No. 3	39.00
29. Three Cells of Bunsen's Battery	9.00
66. Ampère's Frame	18.00
67. Solenoid	1.50
	67.50

Mathematics.

2. Set of Plotting Instruments	7.50

Chemistry.

Selection of Set No. 3	27.75
5. Pair of Gasometers	25.00
7. Pneumatic Cistern	10.00
Selection of Chemicals	20.00
	82.75

Astronomy.

Selection of Set No. 3	19.00
4. Pair of Globes	25.00
	44.00

Meteorology.

Selection of set No. 3	12.00
	$750.00

SET OF APPARATUS No. 5.

Laws of Matter and Mechanics.

2.	Lead Hemispheres	.75
3.	Inertia	1.00
4.	Capillary Tubes	1.25
5.	Capillary Plates	2.00
6.	Ivory Collision Balls	7.00
12.	Parallelogram of Forces	4.50
14.	Centre of Gravity	7.00
19.	Central and Centrifugal Forces	10.00
29.	Endosmeter	1.75
34.	Mechanical Powers	40.00
39.	Gyrascope	7.00
43.	Plateau's Apparatus	6.00

Hydrostatics.

2.	Equilibrium Tubes	4.00
5.	Pressure of Liquids	4.00
6.	Archimedes Principle	5.00
12.	Hydrometer and Jar	3.50
14.	Nicholson's Hydrometer	3.25
16.	Specific Gravity Balance	12.00
21.	Brass Siphon	1.50
24.	Liquid Cohesion	1.00
25.	Hydrostatic Bellows	10.00
26.	Hero's Fountain	8.00
30.	Archimedes Pump	6.00
31.	Tantalus Cup	1.50
37.	Set of Pumps	12.00

Pneumatics.

3.	Ritchie's Improved Air Pump	100.00
10.	Improved Condenser	6.00
14.	Open Top Receiver	4.00
15.	Bell Receiver	2.00
17.	Receiver with Cap	3.50
18.	Straight Jar	1.00
19.	Tall Bell and Jar	3.00
22.	Hand and Bladder Glass	1.00
25.	Freezer	4.00
31.	Magdeburg Hemispheres	7.00
37.	Revolving Jet	1.25
39.	Bell for Vacuum	1.25
40.	Plate and Wood Cylinder	1.00
44.	Upward Pressure	6.00
57.	Fountain	5.00
59.	Guinea and Feather Tube	6.00
63.	Balloon	1.25
66.	Weight and Buoyancy of Air	6.00
70.	Treble Globe	3.00
75.	Expansion Apparatus, quart bell	1.00
79.	Water Hammer	1.00
80.	Rubber Hose	2.00
84.	Sliding Rod	1.75
86.	Air Gun	1.00
88.	Rubber Bag and Stop-cock	2.00
93.	Condensing Chamber and Cock	3.50
101.	Plate Paradox	1.00
	Four Couplers	2.00
120.	Washers and Prepared Oil	1.00

Theory of Undulations.

2.	Improved Wave Instrument, illustrating Polarization	35.00
9.	Kaleidophone	2.00

Acoustics.

1.	Sonometer	30.00
	Wires and Cords	3.00
3.	Iron Screw Press	5.00
5.	Plates of Glass for Vibration	3.50
7.	Brass Plate	3.00
9.	Hopkins's Tubes	6.50
10.	Violoncello Bow	2.00
13.	Diapason	6.00
20.	Interference of Sounds	3.00
31.	Organ Pipe with Piston	3.00

Heat.

1.	Air Thermometer	.50
4.	Mounted Spirit Boiler	2.00
6.	Reflectors in Cases	6.00
7.	Pyrometer	3.50
9.	Conductometer	2.00
12.	Ring and Ball	2.00
13.	Compound Bar	1.25
15.	Leslie's Radiating Cubes	2.00
19.	Non-Conduction by Liquids	1.50
20.	Fire Syringe	1.50
22.	Eolipile	1.50
24.	Wollaston's Illustration of the Steam Engine	3.00
26.	Candle Bombs	.50
27.	Ritchie's Sectional Model of the Steam Engine	35.00

Optics.

2.	Mounted Prism	3.00
6.	Multiplying Lens	.50
7.	Set of Six Lenses	8.00
12.	Eye Models	12.00
13.	Three Mirrors	3.75
15.	Multiplying Mirror	2.00
19.	Kaleidoscope	1.50
20.	Revolving Disc	6.00
22.	Set of Discs	3.50
23.	Liquid Vein Reflection	5.00
34.	Model of Ray of Light	2.50
49.	Newton's Rings	6.00
74.	Microscope	27.00
76.	Botanical do	1.25
77.	Box of Objects	4.00
96.	Magic Lantern	25.00

Electricity.

8.	Ritchie's Improved Electrical Machine, 24 inch Plate	50.00
13.	Movable Coatings Jar	3.50
15.	Diamond Jar	3.00
16.	Battery of Jars	14.00

17. Sportsman and Birds	1.00
20. Improved Set of Jars	4.50
22. Spiral Tube	3.50
24. Ether Spoon	.75
28. Jointed Discharger	3.50
30. Universal do	8.00
32. Electrical Bells	3.00
35. Leyden Jar and Bells	5.00
37. Image Plates	3.00
39. Egg Stand	1.50
40. Dancing Images	.50
41. Pith Ball Electrometer	.75
46. Plate for Dancing Balls	.50
49. Electrical Tellurian	1.50
54. Insulating Stool	6.00
58. Miser's Plate	1.00
59. Luminous Bell Points	1.50
60. Electrophorus	6.00
65. Powder Bomb	1.25
71. Directing Rod	2.00
76. Thunder House and Pistol	6.00
80. Abbe Nollet's Globe	4.00
93. Spider	.50
96. Amalgam	.50
97. Faraday's Muslin Bag	4.00
102. Gassiot's Cascade	2.00
103. Lightning Plate	1.50
104. Head of Hair	1.00
105. Pith Balls, assorted	.50

Magnetics.

1. Bar Magnet	1.00
4. Large U Magnet	1.50
6. Wheel Armature	.75
7. Star Armature	.50
8. Needle and Stand	1.00
9. Dipping Needle	2.50
16. Natural Loadstone	.25
17. Frog Battery	.75
19. Six Breaking Magnets	1.00
23. Sulphate of Copper Battery	6.00
28. Four Cells of Bunsen's Battery	12.00
30. Thermo Arch	5.00
33. Contracting Helix	3.50
36. Decomposing Cell	3.50
37. Powder Cup	.50
38. Voltaic Pistol	3.00
39. De la Rives Ring	1.50
49. Galvanometer	3.50
53. Electro Magnet	1.50
55. Revolving do.	5.00
57. Globe and Coil	4.00
60. Model of Telegraph	5.00
61. Heliacal Ring	3.50
64. Lifting Coil	2.50
71. Analysis of Shocks	12.00
73. Handles	2.00
76. Insulating Wires	.50

Chemistry.

3. Gasometers	35.00
6. Pneumatic Cistern	15.00
14. Chemical Thermometer	2.50
18. Gas Bag and Stop-cock	4.00
22. Hydrogen Balloon	2.00
25. Porcelain Retort	2.00
29. Pendent Spoon	.25
34. Evaporating Dishes	1.00
37. Set of Wire Gauze	.50
38. Crucibles	.20
40. Mortar and Pestle	1.00
48. Cryophorus	2.00
50. Sheet Rubber	.50
52. Rubber Tubing, assorted	1.25
55. Cork Borers	1.50
57. Lamp Stand	2.00
59. Hydrogen Generator	4.00
65. Chemical Tongs	1.00
69. Sefstroem Retort Holder	3.00
74. Spirit Lamp	1.00
78. Blow Pipe	.50
80. Test Tubes and Stand	2.00
87. Filtering Paper	.50
106. Funnel	.25
109. Four Ounce Measure	.65
111. Stirring Rods	.35
114. Safety Tube	.75
116. Pipette	.25
118. Brand's Tube	.50
120. Glass Tubing, assorted	1.50
122. Rupert's Drops	.50
125. Retorts, assorted	2.00
126. Flasks, do.	1.50
127. Digesters	1.20
128. Two Woulfe's Bottles	1.30
129. Two Globe Receivers	.80
Pincers and Rasps	1.00

Astronomy.

4. Globes	25.00
12. Orrery	10.00
13. Seasons	7.00
Astronomical Sliders	18.00
15. Movable Planisphere	2.00

LAWS OF MATTER	$88.25
HYDROSTATICS	71.75
PNEUMATICS	178.50
THEORY OF UNDULATIONS	37.00
ACOUSTICS	65.00
HEAT	62.25
OPTICS	111.00
ELECTRICITY	145.25
MAGNETICS	83.75
CHEMISTRY	95.25
ASTRONOMY	62.00
	$1000.00

SET OF APPARATUS No. 6.

Selection of Set No. 5 . . . . . 1000.00

Chemistry.

Selection of Chemicals 30.00

Magnetics.

86. Ritchie's Improved Ruhmkorff Induction Coil 150.00
87. Set of four Geissler's Tubes . . 20.00

$1200.00

SET OF APPARATUS No. 7.

Laws of Matter and Mechanics.

Selection of Set No. 5 . . . . . 88.25
24. Ritchie's Attwood Machine . . 75.00
30. Illustration of the Pendulum . . 6.00

169.25

Crystallography.

2. Glass Models of Crystals . . . 18.00

Hydrostatics.

Selection of Set No. 5 . . . . . 71.75
9. Masson's Hydrostatic Paradox 15.00
38. Hydraulic Press 30.00

116.75

Pneumatics.

Selection of set No. 5 . . . . . 178.50
95. Glass Condensing Chamber . . 10.00
97. Crushing Squares 1.00
116. Mariotti's Law 20.00

209.50

Theory of Undulations.

Selection of set No. 5 . . . . . 37.00
3. Illustration of Sound Waves . 25.00
4. Illustration of Water Waves . . 20.00

82.00

Acoustics.

Selection of Set No. 5 . . . . . 65.00
11. Nodes of a Bell 7.00
18. Trevyllian's Apparatus 3.50

75.50

Heat.

Selection of Set No. 5 . . . . . 62.25
16. Tall Mercury Cistern 10.00
18. Evaporation of Liquids 12.00
31. Liquefying Gas Apparatus . . . 35.00

119.25

Optics.

Selection of Set No. 5 . . . . . 111.00
4. Prisms for Achromatism 9.00
25. Stereoscope 4.00
Selection of Pictures 14.00
35. Illustration of Polarization . . . 10.00
38. Tourmaline Polariscope 7.00
39. Nicol's Prism 6.00
44. Plates of Crystals 6.00
53. Snell's Accidental Colors 5.50

172.50

Electricity.

Selection of Set No. 5 . . . . . 145.25
25. Insulated Conductor 12.00
44. Gold Leaf Electrometer 5.00
87. Coulomb's Sphere and Needle . 7.50
99. Condenser of Æpinus 16.00

185.75

Magnetism.

Selection of Set No. 5 . . . . . 83.75
66. Ampère's Frame 18.00
67. Solenoid 1.50
80. Henry's Illustrations of Induction 16.00
95. Magneto-Electric Instrument . . 35.00
96. Axial Engine 10.00

164.25

Mathematics.

1. Set of Plotting Instruments . . 15.00

Chemistry.

Selection of Set No. 5 . . . . . 95.25

Meteorology. — Astronomy.

Selection of Set No. 5 . . . . . 62.00
5. Barometer and Thermometer . . 15.00

$1500.00

SET OF APPARATUS No. 8.

Selection of Set No. 7. . . . . 1500.00

Chemistry.

Selection of Chemicals 45.00

Magnetics.

85. Ritchie's Improved Ruhmkorff Induction Coil 225.00
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